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CERVICOTHORACIC GANGLIONECTOMY, TRUNK RESECTION AND RAMISECTOMY BY THE POSTERIOR INTRATHORACIC APPROACH*

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COMPLETE interruption of vasoconstrictor fibers to the arteries of the lower extremities by lumbar sympathetic ganglionectomy and trunk resection has stimulated the development of surgical procedures which would permit equally complete interruption of vasoconstrictor fibers to the arteries of the upper extremities, head, and neck. In order to accomplish such interruption, complete section of the sympathetic nerves to these regions was necessary. Vasconstrictor impulses are carried over the thoracic sympathetic outflow by white rami communicantes, as preganglionic fibers, to end in synaptic connections with ganglion cells in the upper thoracic and cervical sympathetic ganglia. From these ganglia the impulses are carried by postganglionic gray fibers to the arteries, by way of the thoracic and cervical nerves. Intermingled with the vasoconstrictor fibers, are sympathetic fibers, which supply the pilomotor muscles and the sweat glands.

The object of the surgical procedure mentioned is to remove all central influence, and to permit the arteries to dilate to a size larger than normal. Jaboulay and Leriche, in their early work, attempted to bring about vasodilation by periarterial sympathectomy. They expressed the belief, originally, that innervation was centrifugal, and later that it was centripetal. More recently, Leriche and Fontaine still held that there existed an intramural ganglion which maintained the vascular tonus of the arterial wall. However, Kramer and Todd, and Potts, by anatomic and histologic studies, have shown that this does not exist and that the vasomotor innervation of the arteries corresponds to the musculocutaneous distribution of the spinal nerves, which explains the incomplete results of periarterial sympathectomy.

Royle, in attempting to relieve spastic paralysis, introduced the operation known as ramisection, but since the gray rami are not constant in their origin or distribution it became apparent that fibers were missed at operation. Hence, I proposed and performed ganglionectomy and trunk resection to assure complete interruption of vasoconstrictor fibers. In treating a vasospastic lesion of the lower extremities, I performed bilateral lumbar ganglionectomy, including the second, third, and fourth lumbar ganglia, besides resecting the lumbar sympathetic trunk. This procedure thoroughly interrupts all postganglionic fibers which come from the lumbar ganglia and those which descend through the lumbar sympathetic trunk. Inasmuch as no white rami enter ganglia below the second lumbar ganglion, it might be sufficient merely to section the lumbar trunk below this level if one were certain that stray rami did not descend from above as individual fibers or through the aortic

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plexuses. Therefore, I believed it wiser to err on the side of safety, by doing too much rather than too little, since complications do not arise from the more extensive operation.

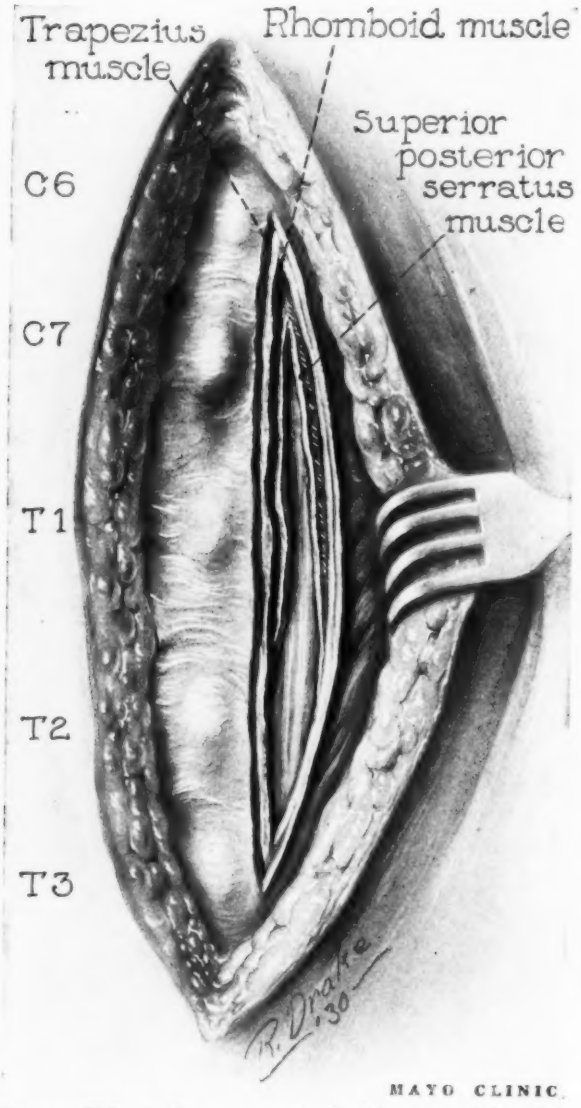

Fig. 1. Skin and aponeurotic incision on right side, preliminary to cervicothoracic ganglionectomy.

The problem of sectioning all vasoconstrictor fibers to the arteries in the upper extremities has been much more difficult. Jonnesco, in 1916, described a surgical procedure for angina pectoris, by which the middle cervical and the stellate ganglia were resected through the anterior approach. Later, this was employed by Bruening in the treatment of Raynaud's disease and of scleroderma of the hands. Unfortunately, my experience with the operation in similar diseases has been unsuccessful. Royle's cervical ramisectomy and his later cervical ramisectomy and trunk resection, affecting structures below the first thoracic ganglion, performed through the anterolateral approach, likewise were insufficient to produce complete vasorelaxation of the arteries.

Kuntz, after anatomic studies, explained these failures by the fact that postganglionic rami ascend from the second, and occasionally from the third, thoracic ganglion and pass directly to the brachial nerves without passing through the stellate ganglion. Thus it was obvious that if complete interruption of vasoconstrictor fibers was to be accomplished it would be necessary to resect the thoracic trunk below the second thoracic ganglion, including the first and second thoracic ganglia, in the hope of interrupting all trunk fibers which ascend to the cervical ganglia. In developing this procedure, I learned that Sherrill, in 1910, performed thoracotomy by the posterior approach, resecting the second, third, and fourth ribs in order to ligate the subclavian artery. Henry, also, in anatomic studies, called attention to the anatomic relationships of the subclavian artery and cervicothoracic ganglia following resection of the second thoracic transverse process and rib. Owing to the fact that Raynaud's disease and allied vasomotor disturbances are bilateral, it was necessary to devise a surgical procedure that would permit bilateral cervicothoracic ganglionectomy and trunk resection. This was carried out by me July 31, 1928, at which time I opened the posterior mediastinum after resection of the second rib on each side of the spinal column, removing the second thoracic ganglion and what I believed to be the cervicothoracic ganglion, with the intervening trunk. This, it was hoped, would effect vasorelaxation of the arteries, but it was soon observed that an incomplete Horner's syndrome, with incomplete dila-

tation of retinal arteries, appeared following some of the operations. This made it apparent that sympathetic fibers were entering a portion of the lower cervical ganglia. I learned further that when the lower cervical and the upper thoracic ganglia were not fused into a stellate ganglion, I was removing only the first and second thoracic ganglia and the intervening trunk, leaving the lower cervical ganglion, which was receiving fibers from some source other than the first and second thoracic ganglia and upper thoracic trunk. Again, the procedure required more extensive resection in order to attain complete vasorelaxation and uniformity of Horner's syndrome on both sides. Hence, the present technique was developed.

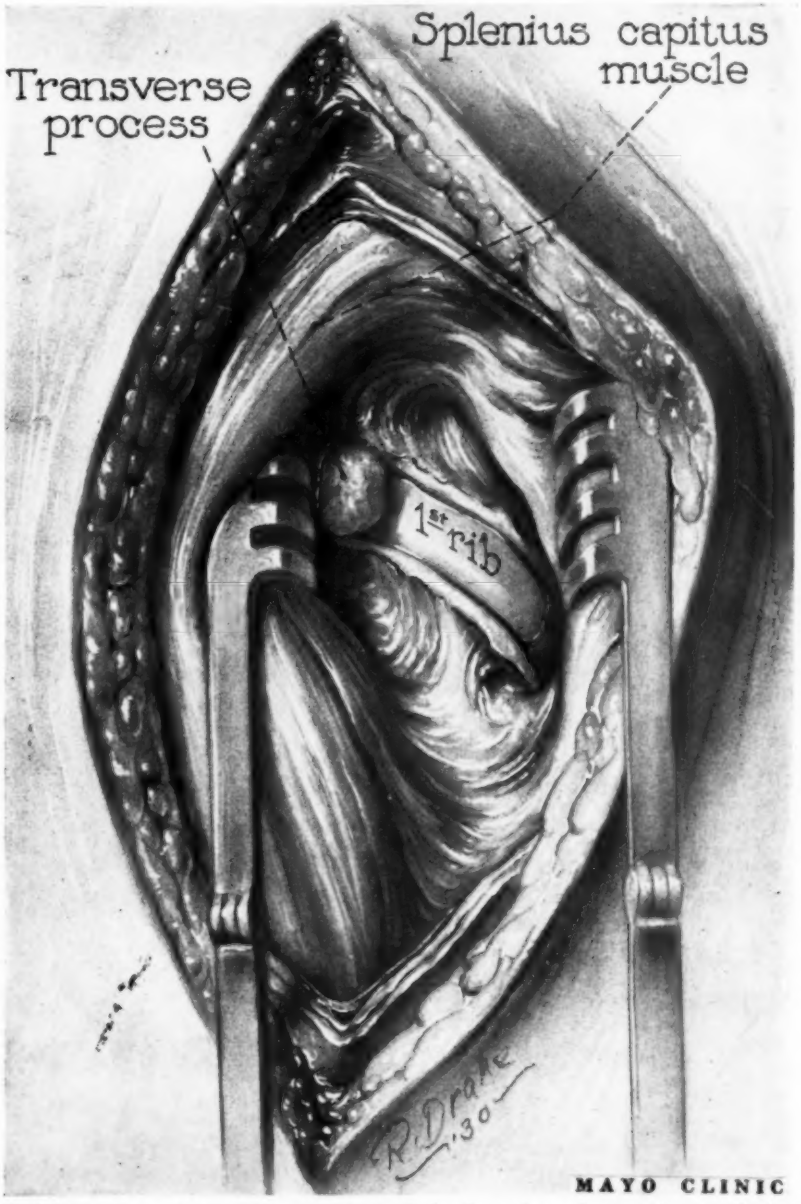

FIG. 2. Exposure of first rib and transverse process of the first thoracic vertebra preliminary to resection.

This technique differs from the one described previously[3] in that the thoracic midline incision is extended upward to the spine of the sixth cervical vertebra and is extended downward only to the spine of the third thoracic vertebra. The medias-

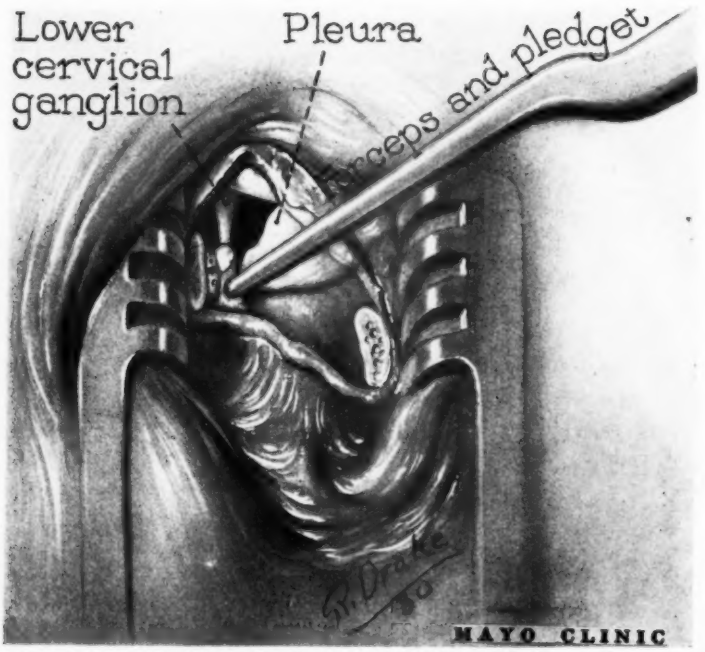

FIG. 3. Dissection exposing thoracic trunk following resection of first rib and transverse process of the first thoracic vertebra.

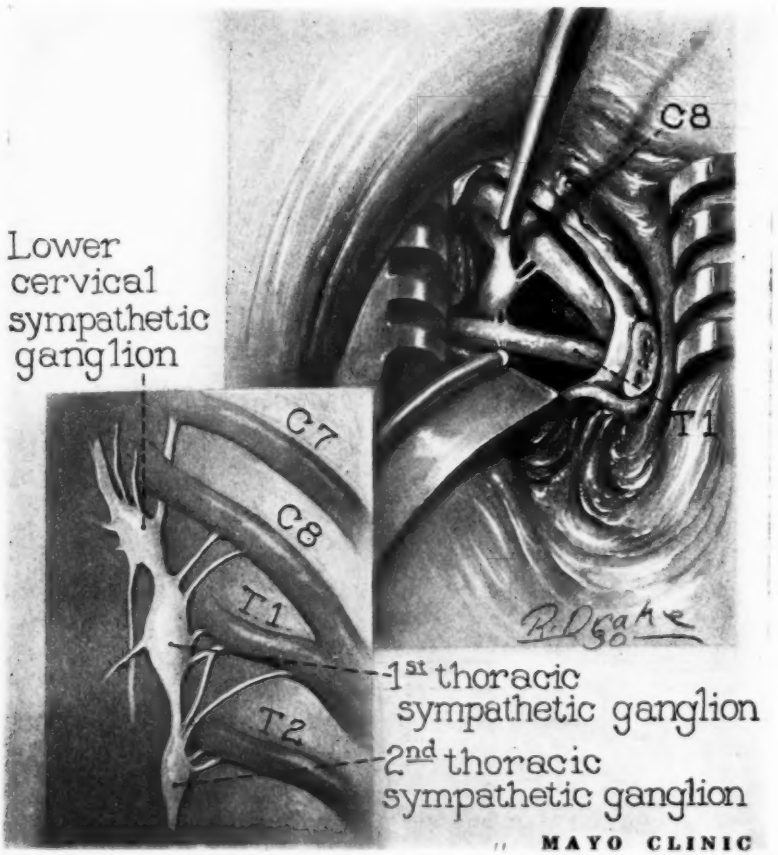

FIG. 4. Delivery of lower cervical and first thoracic ganglia into the wound between the eighth cervical and the first thoracic nerves with schematic drawing illustrating relationship between cervicothoracic ganglia and the brachial plexus.

tinum is entered posteriorly after sectioning the transverse process of the first thoracic vertebra and the proximal portion of each first rib. This permits one to encounter the stellate ganglion if the lower cervical and the first thoracic ganglia are fused, or to encounter the thoracic trunk between the lower cervical and the first thoracic ganglia if these ganglia are not fused. It assures complete removal of the lower cervical and the first thoracic ganglia with the intervening trunk. However, through this approach, one is not always able to remove the second thoracic ganglion; therefore, to insure against rami from the second or even the third thoracic ganglion entering the lower trunk of the brachial plexus, all rami and branches of the eighth cervical and first thoracic nerves are carefully dissected and interrupted. In addition, extreme care must be taken to interrupt any stray rami that may pass upward mesially to the thoracic trunk, ascending from the lower thoracic ganglia into the brachial plexuses.

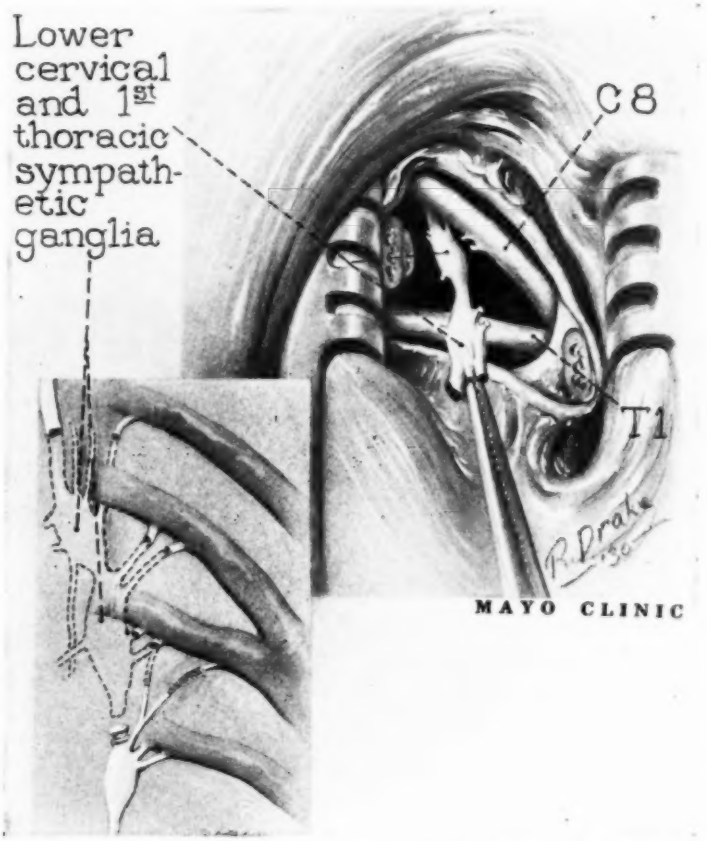

Fig. 5. Resection of lower cervical and first thoracic sympathetic ganglia with the trunk in conjunction with ramisectomy of fibers extending from the second or third thoracic ganglia to the first thoracic and eighth cervical nerves.

The results obtained by this procedure, compared with those obtained by the former technique, are better. The Horner's syndrome always has been complete, and the retinal arteries and veins have remained permanently dilated, according to the measurements made by Wagner. Although the vasodilating effects have been extremely satisfactory, and many patients have been cured, suggestions of central vasomotor influence in localized cutaneous areas have appeared. This would indicate that occasionally vasomotor fibers are still missed, and would suggest that they probably passed upward mesially

to the thoracic trunks, or through the cardiac plexuses, to enter the cervical nerves. Thus it will become necessary, probably, in these occasional cases to follow cervicothoracic ganglionectomy with a Royle type of cervical ramisectomy.

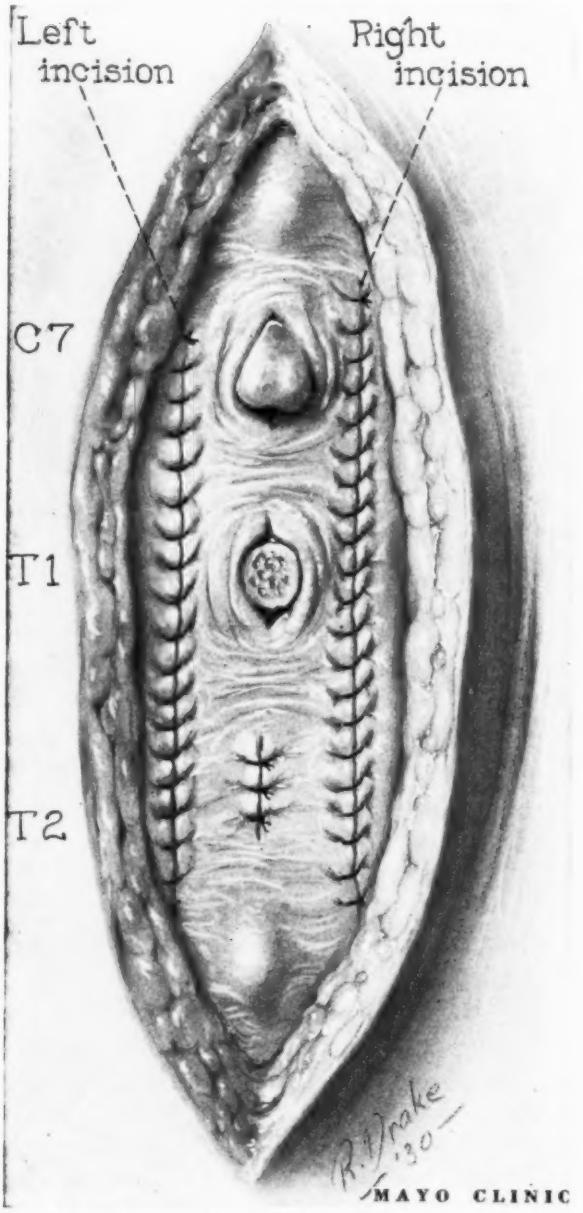

FIG. 6. Partial resection of spines of prominent cervical and thoracic vertebrae during closure of wounds.

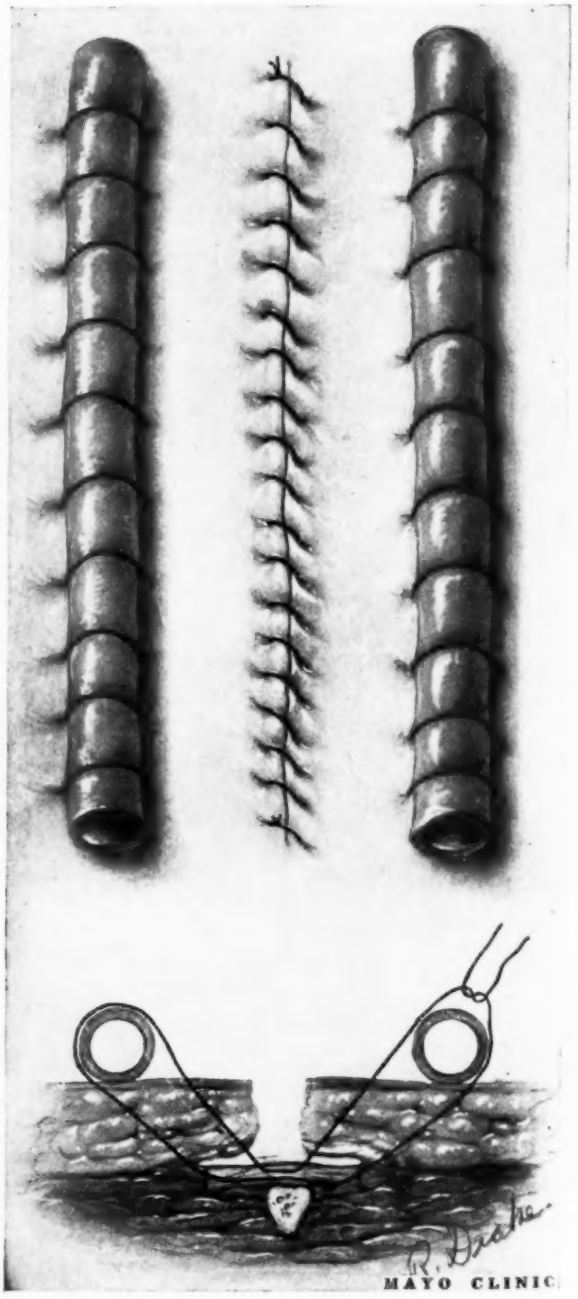

FIG. 7. Closure of skin and fascial planes with dermal and tension sutures.

[For Bibliography see p. 268.]

PRESENT-DAY CRITERIA OF

X-RAY DIAGNOSIS OF DUODENAL ULCER*

PART I

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THE direct study of the local roentgenological appearance of duodenal ulcer in itself, which at the present time has nearly everywhere replaced the older, indirect method, by which the diagnosis of duodenal ulcer was based solely on certain functional or secondary gastric signs accompanying it, may be dated back about twenty years when Barclay in 1910 described the persistent "bulbusfleck" as a direct sign of ulcer and Haudek in 1911 for the first time emphasized the niche in the duodenum as an indication of an ulcer crater filled with opaque substance.

FIG. 1. Woman, aged forty. Brief periodical symptoms of ulcer for a couple of years, worse during the last few weeks. Superficial niche on anterior wall with surrounding slight concavity, only visible in second oblique position. Niche completely disappeared after one month's treatment.

In the course of the past two decades the direct diagnostic method of duodenal ulcer has had a steady and powerful development and may now be said to have reached a very high degree of precision.

* Submitted for publication November 1, 1930. From the Roentgen Section, Maria Hospital, Stockholm. Physician in Charge: Åke Åkerlund.

FIG. 2. Woman, aged fifty-three. Symptoms of ulcer for a few months, worse during the last month. In second oblique position a niche formation, the size of a hazelnut, with surrounding alteration of contour appeared on posterior wall of bulb; in other projections one found no bulbar deformities.

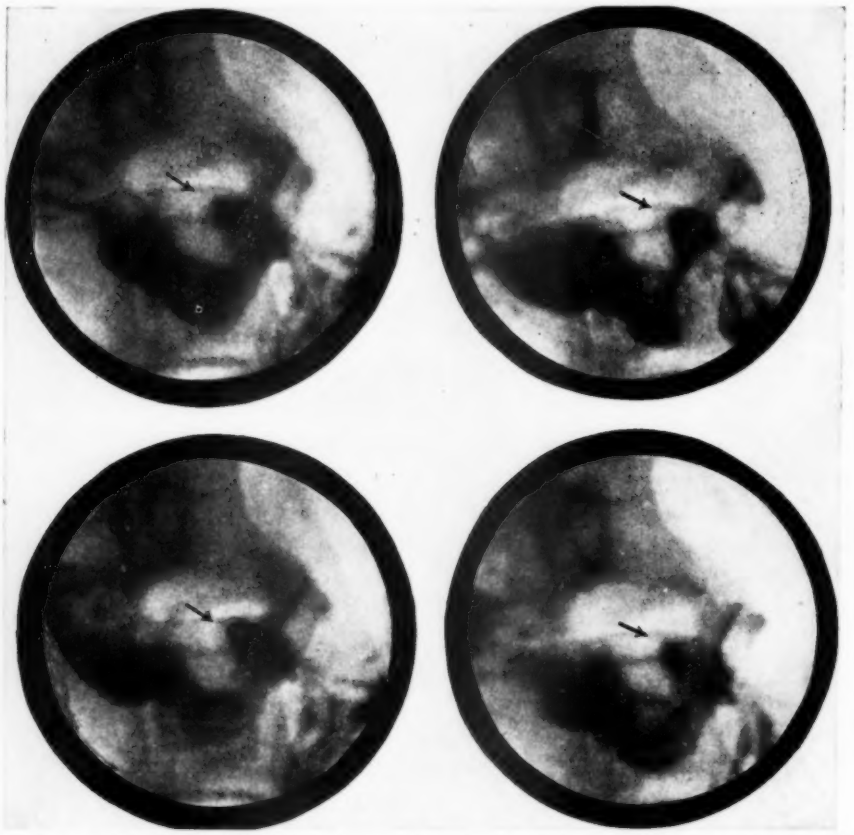


FIG. 3. Serial exposure at intervals of half a minute; focusing and degree of compression previously controlled on screening, exposures then made consecutively without further screening, thus without aiming, in the sense of Berg (not "gezielte Aufnahmen"). Nevertheless the niches appear just as clearly on all the roentgenograms. Recent en-face niche in first oblique position.

In this paper it is impossible to give even a summary account of the development within this field of research in the different countries; but it must be admitted that here, as in so many other scientific branches, America took an early lead, and as chief exponents of this phase of roentgen diagnosis mention must be made of three investigators, Cole, George and Carman.

With regard to all historical particulars the reader is referred to the author's detailed work[1] and to H. H. Berg's book[2] both of which include detailed surveys of the literature and bibliographical references.

That this method of diagnosis, so highly developed at the present day, has not yet become available in all its fine points to every radiologist is explained not only by the extremely subtile technique, sometimes both time-consuming and tedious, which is used, but also by the extensive personal experience required in order to make a correct interpretation of the details in the frequently quite complicated roentgenographic shadows.

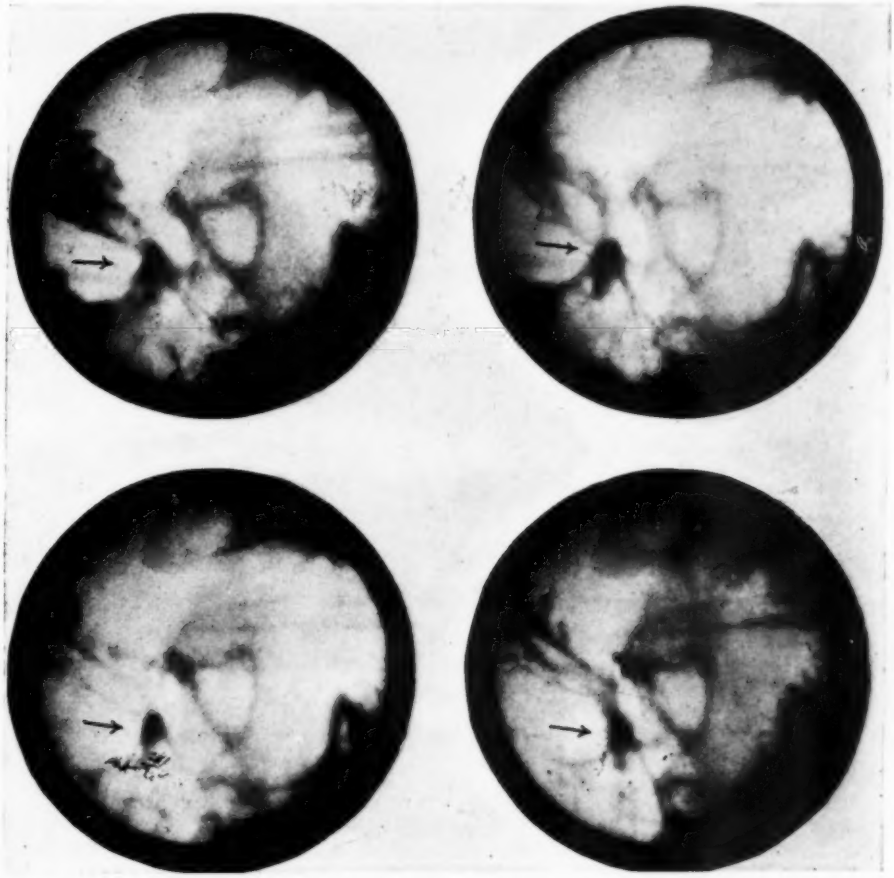


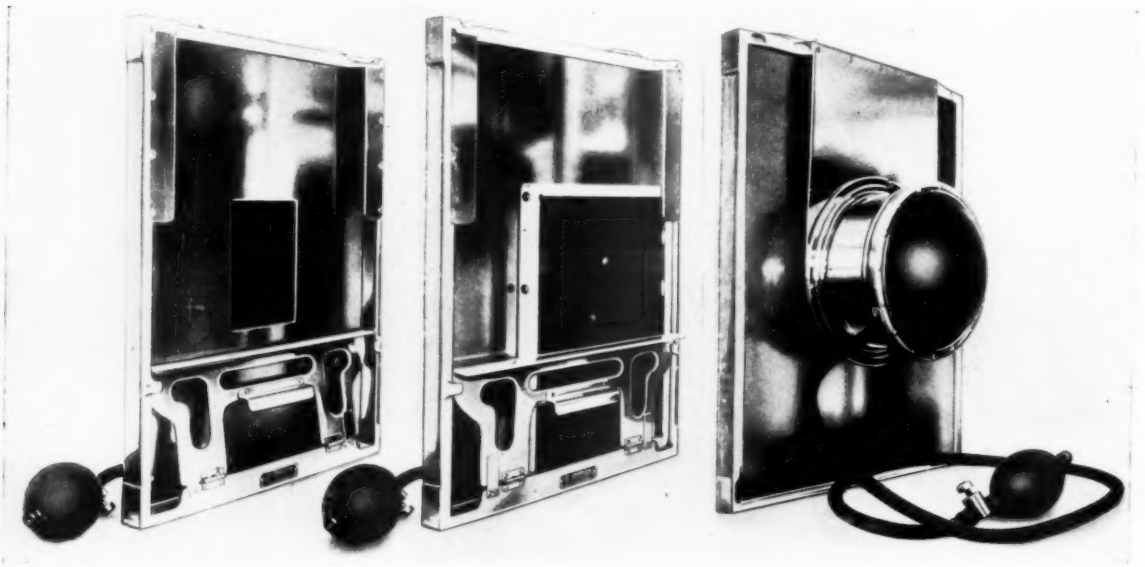
FIG. 4. Serial exposures under same conditions as in preceding illustration. Sagittal projection: Most of bulbar shadow eliminated by compression, niche thus appearing clearly on all roentgenograms.

Technique. On account of the exceedingly important bearing that technique has on the *x*-ray examination of the duodenum it will be necessary to deal with this at some length. The reason so many investigators have failed as yet to realize that duodenal roentgenology is one of the most grateful sections within the whole field of diagnosis is above all a lack of knowledge of, and a want of interest in, technical matters.

In a roentgenological study of the duodenum it is more important than in the rest of the digestive tract to *combine intimately screening and filming.*

The screening must necessarily be very

FIG. 5. Serial films exposed under same conditions as two preceding ones. Second oblique position: niche on posterior bulbar wall, close to pylorus, visible on all roentgenograms.



A B C

FIG. 6. Serial frame. A. From behind with window visible. B. With casette inserted. C. From front with compression tube and rubber-balloon.

thorough and be used not merely as a general means of orientation before the taking of films: the duodenum must be studied on the screen in different positions of the body (upright, supine, prone, oblique and lateral) and with simultaneous *palpation* and *displacement*, as also under different degrees of *compression* and *projections* (best under continuous alteration of projection, Haudek's so-called "fliessende Rotation"). In any case not only should sagittal projections be made but also those with the patient rotated more or less towards the left, the first oblique position, and more or less towards the right, the second oblique position (Figs. 1, 2).

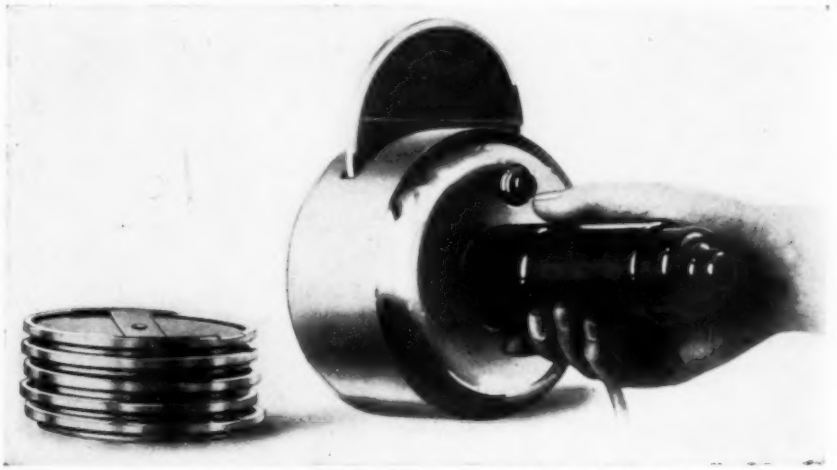


Fig. 7. Spiral diaphragm compressor with round film casettes, one of which is seen partly inserted in diaphragm.

At least one film should be made in every position even if nothing abnormal has been detected during the fluoroscopy and in the case of a suspect or pathological appearance several exposures should be made or serial films exposed in the various positions.

If a good result is desired one must on no account have the exposures made independently of the screening, e.g., with another apparatus or perhaps even in a different room by an assistant.

To get as much as possible out of duodenal films and to make them yield the greatest possible information it is an indispensable condition that *every exposure should be made under direct screening control*, with the best possible projection and the most suitable degree of compression having been chosen. *A series of x-ray films exposed under such conditions yield still more information than the most thorough fluoroscopy; the detailed checking of the film by*

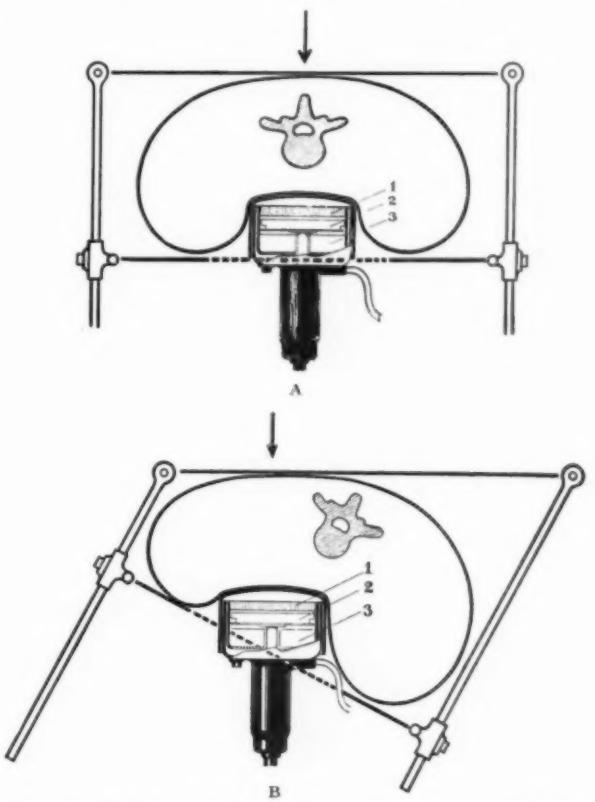


Fig. 8. Spiral diaphragm in compression position, introduced into tube mounted on the casette-holder: A. Direction of projection straight against direction of compression. B. Direction of projection deviates from direction of compression. 1 = spiral diaphragm. 2 = space for casette. 3 = electric motor.

FIG. 9. Niche, size of a linseed, with circular ridge, only visible on films exposed with spiral diaphragm compressor.

FIG. 10.

FIG. 11.

FIG. 12.

screening is a necessary condition in obtaining such a series.

The requirement for an intimate cooperation between screening and filming in duodenal examination has resulted in a specialized technique "der gezielten Aufnahmen," the originator of which is the foremost exponent of ulcer radiology in Germany, H. H. Berg. The purpose of this technique is to be able to make an instantaneous exposure by a single movement of the hand whenever desired during the screening in order to catch on the film precisely that optimum view, that phase in the steadily changing picture when the altered appearance of the bulb is most clearly and distinctly placed in the most favorable projection. This technique requires not only an instantaneous device of transition ("Schnellschalter") from screening to exposure voltage for the *x*-ray tube but also an equally rapid exchange of the fluoroscopic screen for a film-casette. By the use of a Berg shunter and exchange

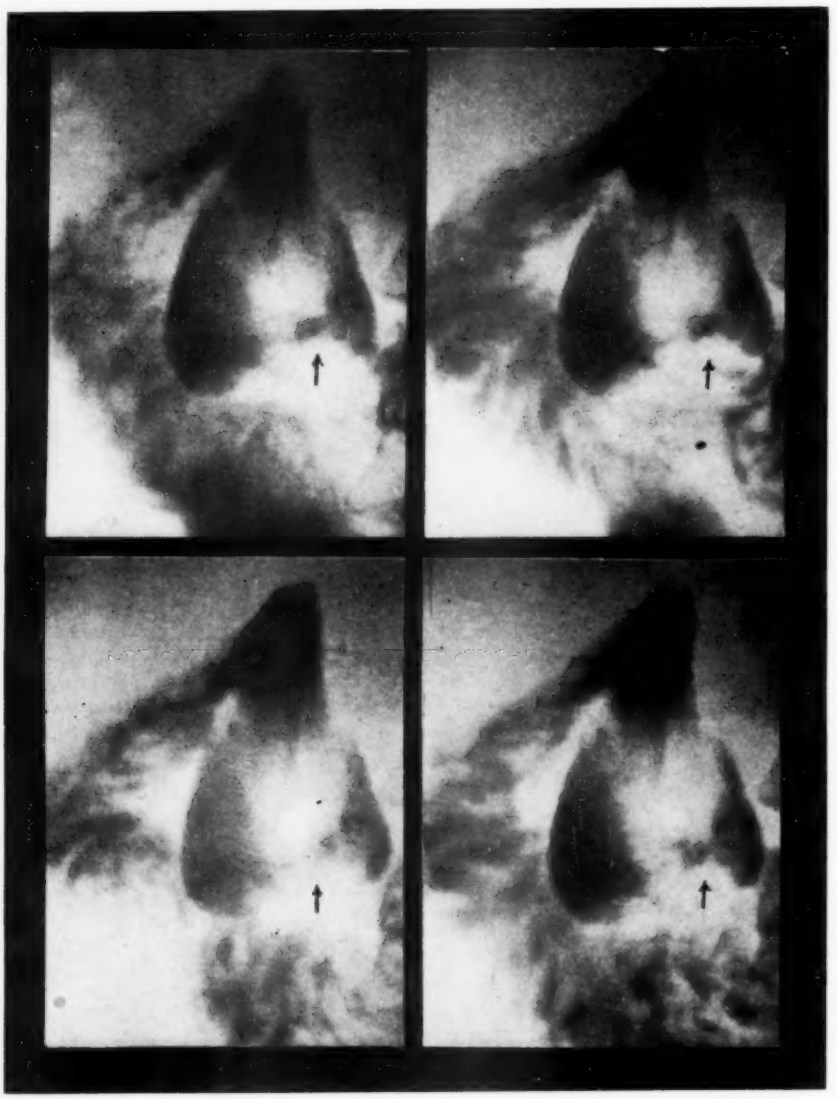


Fig. 13.

Figs. 10–13. Married woman, aged thirty. Symptoms of ulcer, particularly marked during last week. On Fig. 10 without compression there is no bulbar deformity whatever, on slight compression (Fig. 11) an ill-defined niche can be seen through the bulbar shadow and on strong compression (Fig. 12) niche is distinctly seen, as also on all films of a whole series (Fig. 13).

frame an exposure can be interposed during the screening in a fraction of a second.

Berg's "gezielte Aufnahmen" have been of great importance in the development of duodenal diagnosis in Germany, not the least of which is pedagogical; this method intensifies and keeps alert by daily training the power of observation of the radiologist in the art of screening; it renders the detection of an ulcer an exciting "shooting" practice and the results obtained by this method are a good indication of the technical skill aquired by the operator. Moreover, the method saves films and is thus very economical: a skillful radiologist can obtain by one or two exposures ideal and exhaustive pictures.

Yet this method has in my opinion a fairly great drawback since it compels the operator to retain his place during the exposure directly in front of the roentgen tube whereby, despite various protective measures, he is more or less unnecessarily exposed to the powerful radiations.

Fig. 14. First roentgenogram *without* compression shows niche indistinctly through bulbar shadow, other films *with* compression all show an obvious niche.

The roentgenograms of the opaque filling of a compressed bulb which are obtained do not usually, however, vary so rapidly as to render it absolutely necessary to make the exposure at an exact moment. Besides, with an unaltered position and

compression an optimal phase of the filling usually returns soon. To an experienced radiologist, therefore, who is not particularly concerned with the reduction of the number of exposures to the least possible, this excellent but dangerous method of "hitting the spot" is not, fortunately, an indispensable condition; by a moderate number of *serial exposures* centered under control of the screen the same practical result can be obtained without having to neglect the demand of efficient protection (Figs. 3, 4, 5).

FIG. 15. Married woman, aged thirty-five, with symptoms of ulcer lasting for many years. Without compression no visible bulbar deformity. With compression there is seen a niche, the size of a coffee-bean, close to minor curvature side.

The device I use for making 4 serial roentgenograms on a 18 × 24 cm. film, is very simple and has only been slightly modified during the past decade. The present appearance of the *serial frame* will be clear from Figure 6. A lead plate is mounted in the frame with a rectangular window in the middle measuring 12 cm. in height and 9 cm. in width, thus, just a quarter of the surface of the film used. The film-casette is shifted between the exposures along the inner border of the frame. When one of the corners of the casette abuts against the corresponding corner of the frame, the diagonally opposite corner of the casette will be directly in front of the window in exposure position. The casette is well supported in every position, in the two upper positions of exposure being supported by a plate with an automatic spring action. The serial frame can be easily adapted to every stand; it need only be hung over the edge of the casette holder. For centering the film the ordinary screen placed behind the lead window of the serial frame is used.

The serial frame is provided with a special tube-shaped "Vordeblende" the screening-off effect of which can be in-

tensified by a series of exchangeable diaphragms, naturally at the expense of the size of the roentgenograms; the smallest compression tube, is pressed tightly against the organ to be examined, in this case the duodenum. The diaphragm is charged

Fig. 16. Niche only visible on roentgenograms taken with spiral diaphragm compressor and with strong compression, but not on numerous other films.

diaphragm gives a roentgenogram with a diameter of 6 cm. The necessary compression can be obtained as desired by the diaphragm tube. A very convenient extra compression device allowing the finest pressure variations is mounted to the serial frame in the form of a rubber balloon; this is placed on the tube facing the patient and the pressure can easily be regulated under screening control by a rubber ball and a discharge valve connected with the balloon by a rubber tube (Fig. 6c).

In duodenal examination I have also used extensively the spiral diaphragm compressor ("Spiralblendenkompressor") described in greater detail elsewhere[4] (Figs. 7, 8). As the name implies, this consists of a small efficient rotatory secondary diaphragm which, enclosed in a with a series of circular film-casettes having a diameter of about 12 cm. Here, too, the focusing of the film is done under screening control.

The greatest advantages of this apparatus over the afore-mentioned serial frame are that it efficiently shuts off the scattered rays, allows a larger field of exposure and, by avoiding the increased distance between object and film occasioned by the insertion of a tube-shaped "Vordeblende," improves the definition of details.

I have a large series of duodenal cases among which I have been able to demonstrate thinner niches of smaller size on roentgenograms only when roentgenographed with the spiral diaphragm compressor and not on several ordinary serial films (Fig. 9). Nor is there any other

FIG. 17. Normal folds of mucous membrane in duodenal bulb, apparent on correct dosage of compression.

FIG. 18. Compression roentgenogram with normal folds of mucous membrane in duodenal bulb.

method, so far as I am aware, with which one can show such punctiform niches of the size of pin-heads such as I have been able to demonstrate by this apparatus. On the other hand it must be admitted that this fairly complicated apparatus is just as sensitive and delicate as an ingenious camera: as it is not an apparatus for beginners it requires exceedingly great precision in its use in order to yield good results.

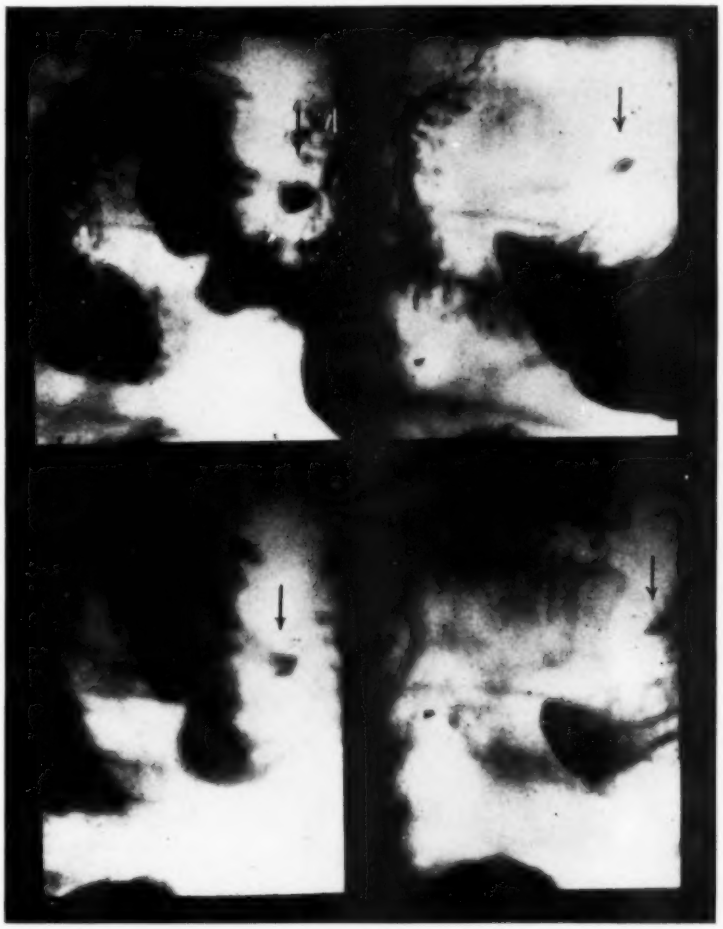


Fig. 19. Bulbar niche with long stalk-like connection with rest of bulbar shadow, perforated on being extracted during operation.

The routine use of *direct local compression of the bulb* is of very great importance in the demonstration of niches. This question has been dealt with in greater detail elsewhere[5] where by a number of illustrations I showed that large niches may be missed by an examiner who does not purposely make use of the direct duodenal compression of the bulb (Figs. 10–16).

The compression technique has, particularly in the hands of H. H. Berg, been developed to masterly perfection, to which the brilliant roentgenographic material in his latest work on ulcers bears witness (1926, 1930).

A suitable degree of compression is a condition essential to a detailed study of the finer changes in the relief of the mucous membrane of the bulb. The degree of compression must be carefully tested or dosed under screening control; too little or too much spoils the picture and the optimum has rather narrow limits. It is a desideratum that the direction of compression too should be made independent of that of projection, at least within certain limits, although these directions frequently coincide. For it sometimes happens that a far better compression record is obtained

if one can apply the compression at a certain angle against that direction of projection which one is compelled to use in order to get the best possible free-projected roentgenograms of the duodenal bulb (Fig. 8B).

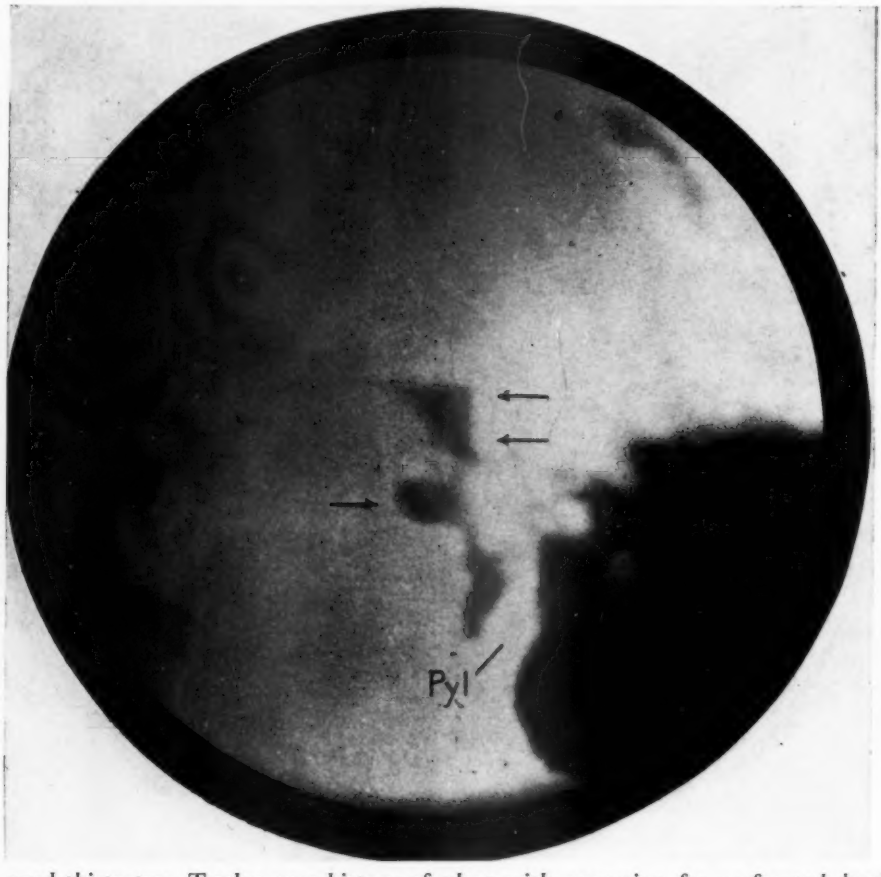


FIG. 20. Man, aged thirty-two. Twelve-year history of ulcer with operation for perforated duodenal ulcer two years ago. Fresh symptoms during last year. Presents double niches on compression roentgenogram, one lower rounded and one upper triangular; in second oblique position these niches prove to belong to anterior and posterior bulbar wall respectively.

Besides the spiral diaphragm compressor and the previously mentioned rubber balloon on the serial frame, I make use of hard cushions or balls of cotton wool of various sizes, and sometimes slices of cork or semi-spheres of aluminum as well. These different compressors are placed between the casette-holder and the patient; the casette-holder is fixed in any desired position of compression, also in oblique positions in respect to the direction of projection, by an automatic catch device.

Among other technical devices which facilitate the examination of the duodenum it is desirable to have a *primary diaphragm with tubal effect* and with, of course, an adjustable opening. A diaphragm of that nature enormously improves the quality both of screening and films. Such diaphragms of different kinds have lately been put on the market, the "step-shaped diaphragm" of Siemens-Reiniger-Veifa's make and the "anti-diffuser-diaphragm" as suggested by H. H. Berg. Not long ago I demonstrated an exceedingly simple device consisting of a cylinder about 20 cm. in length in the longitudinal axis of which a circular diaphragm could be adjusted. With the circular diaphragm farthest back in the cylinder, right against the roentgen-ray tube, the beam of rays let through is sufficiently large for a surveying view of the stomach and duodenum; with the diaphragm shifted as far forward

FIG. 21.

FIG. 22.

FIGS. 21, 22. Man, aged thirty. Periodical symptoms of ulcer for last two years. In first oblique (Fig. 21) projection an en-face niche is seen through center of deformed bulbar shadow, latter showing several defects. In second oblique projection (Fig. 22) where niche appeared as profile niche, it proved to belong to anterior bulbar wall. Operative verification.

FIG. 23.

FIG. 24.

FIGS. 23, 24. Man, aged sixty-four. Periodical symptoms of ulcer of many years' standing, worse during past six weeks. Sagittal roentgenogram with compression (Fig. 23) shows en-face niche, size of bean, towards which defects converge from all sides. Film exposed in second oblique projection (Fig. 24) shows niche is plateau-shaped and that it belongs to anterior bulbar wall. Corresponding incisura on posterior wall.

FIG. 25. Man, aged tweenty-six. Three years' history of ulcer. On compression are seen three niches, size of peas, located in a row within deformed bulbar shadow.

FIG. 26.

as possible in the cylinder it lets through a beam of rays with a diameter of about 4 cm.

Before leaving the technical details it should only be added here that duodenal examination requires a roentgen-ray apparatus of sufficient effectivity to need no longer exposure than two to three seconds for obtaining sharp definition of details.

The patient is examined on an empty stomach, or not sooner than four hours after a light breakfast, mainly fluid, and without having subsequently taken any solid or liquid food. Patients with sluggish bowels or a tendency to flatulency are given an enema but no aperients before the examination. Gastric contents on the fasting stomach, if present in any large quantities, should be aspirated before examination.

The opaque meal must be fairly thin, absolutely homogenous and without any disturbing degree of sedimentation. There are several satisfactory preparations of this nature on the market. The simplest perhaps is the suspension of pure barium sulphate in water in a proportion of 3:4 as recommended by H. H. Berg. For my own part I have been mostly using Forssell's thin fruit-juice gruel and in recent years the German preparation "Roebaryt" or Chaoul's "Lactobaryt." I have also tried a number of American preparations without having found any principal difference between them or a general superiority of any one in particular.

The duodenum should be examined in a filled state and also the finer details of the mucous nembrane should be studied in a

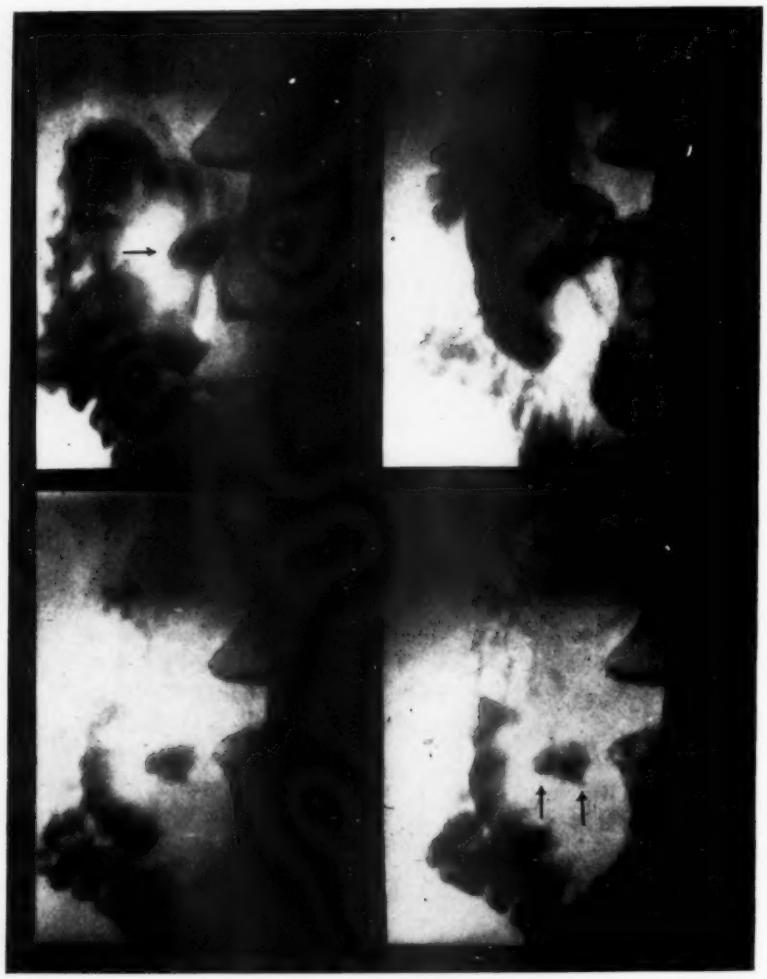


Fig. 27.

contracted as well as in a compressed condition (Figs. 17, 18). The patient having taken only one or two mouthfuls of opaque substance, a very good relief film can be obtained by manipulating under screening a sufficient quantity into the duodenum. By suitable compression equally instructive relief films can generally be obtained when the patient has taken the whole of the opaque meal (about 300 gm.). A simple way of getting the bulb well filled is to put the patient after taking the meal into the right lateral position for a few minutes or, in exceptional cases, somewhat longer. The filling can be improved by manual expression, repeated if necessary several times in succession.

Fig. 28.

Figs. 26, 27, 28. Married woman, aged sixty-two. Prolonged dyspeptic symptoms. Has lost weight and color, cancer suspected. Without compression no deformity of bulb on sagittal projection. On compression (Fig. 26) an en-face niche appeared, size of a pea, which on oblique films (Figs. 27, 28) proved to be caused by two contact ulcers ("kissing ulcers").

It is not always possible to carry out a roentgenological examination of the duodenum strictly according to rules; the radiologist must learn to individualize according to the circumstances of the case.

The most important examination and the one that yields most information is generally that with the patient in a standing position; it is best to begin with this position. Surveying films are first made followed by a series of special exposures; one then proceeds with the various reclining positions in which surveying films are generally sufficient, but in certain cases it is also necessary to make serial exposures.

As a rule, in every examination of the

stomach or duodenum, besides the surveying films in standing, supine and prone positions, I expose at least one group of serial films (4 exposures) either in the sagittal projection or under rotation of the patient more or less towards the left (first oblique position) and at least one series with rotation of the patient towards the right (second oblique position); thus obtaining at least two series of films in projections more or less at right angles to each other. In case the findings are indecisive other films are immediately exposed.

Fig. 29.

It is made a rule never to make roentgenograms without having first paid careful attention to position, extent of filling, compression and projection under screening control.

It might seem that such an examination would prove in practice far too tedious and time-consuming but that need not be the case. With increasing experience and practice a duodenal examination, including examination of the stomach, can with this technique be carried out in fifteen minutes in simple cases and in complicated cases in thirty minutes at the most, not including, of course, the time occupied for subsequent analysis of the films and the making up of the report.

Direct Ulcer Signs. Of roentgenogically demonstrable local changes produced by an ulcer in the duodenum those concerning the shape of the duodenum are undoubtedly the most important, being the most constant and characteristic. Since the duodenal ulcer is, according to extensive statistics in far the majority of cases (Gruber, 83 per cent, Collin, 92 per cent, and Mayo, in 99 per cent), localized to the first onion-shaped, dilated part of the duodenum, it is therefore the alterations in shape within this part, the "bulbus duodeni" (Holzknecht) or Cole's "cap of the stomach" that constitutes the central point in the direct roentgen-ray examination of duodenal ulcer. Compared with the *deformities present in the bulb,*

the other local changes roentgenologically demonstrable, which a duodenal ulcer may produce, play a very subordinate part in the definite diagnosis of ulcer; but on the other hand these changes referring to the *size, position, direction, displaceability, motility and sensitiveness to pressure* of the bulb, may offer certain valuable pieces of specialized information in the clinical estimation of the case.

Before we enter into a closer analysis of the deformity of the bulb produced by ulcers the following question may be raised: *Is every ulcer of the bulb accompanied by a deformity demonstrable by roentgen rays?*

On the strength of the experience I have accumulated in the course of more than twelve years of fairly intensive practical work in this special field, I should like to answer the question thus: Every open ulcer of the bulb which extends more deeply than the purely superficial defects of the mucous membrane in fresh acute ulcers causes an alteration in shape or outline of the opaque contents of the bulb, which by the help of an exquisitely careful technique (such as that already described), when practiced by an experienced radiologist, is practically always roentgenologically demonstrable. It stands to reason, of course, that under conditions particularly unfavorable for an examination, such as cases of marked adiposity, or in case of incomplete examination, as in patients greatly weakened by loss of much blood or a long stay in bed, or otherwise delicate in health, smaller changes might at times be missed by the examiner.

It is quite certain that single entirely normal films of the bulb or a whole series of normal films exposed in a certain projection and perhaps without compression do not justify us in excluding a deep duodenal ulcer (see Fig. 2, 10–16). It has been long known that with the bulb filled to a certain extent and with the roentgenogram made at a certain projection even a chronic indurated ulcer may very well be hidden and the bulbar shadow present quite a normal appearance. In order to be able to exclude a deformity a close analysis of the bulbar area, made by screening under palpation, compression and continuous

Fig. 30.

Figs. 29, 30. Woman, aged forty-three. Periodical symptoms of ulcer for the past eighteen months. On sagittal compression film (Fig. 29) with sufficiently strong compression to eliminate the rest of the bulb, two niche formations, the size of peas, appear partly covering each other. In second oblique projection (Fig. 30) niches proved to be situated opposite each other on anterior and posterior bulbar wall respectively ("kissing ulcers").

change of position (Haudeks "fliessende Rotation") and also by different series of roentgenograms made with suitable compression in various projections, is required.

When a deformed bulb has been demonstrated it must be subjected to a *detailed analysis* regarding its *shape;* it is not enough to be content as formerly with a general description and to liken it to some common form such as a clover-leaf, coral branch, pine branch, butterfly and the like. It is a question of analyzing the different form-components entering into the deformity and, if possible, trying to form an expression of the pathological-anatomical or functional basis of these different components.

These different components, which to-

gether may make up a roentgenological ulcer deformity of the bulb, and which may occur either separately or in different

Fig. 31. Married woman, aged thirty-one. For past two years brief periods of epigastralgia. On compression were seen two niches, partly covering each other on roentgenogram and surrounded by a wallshaped defect ("kissing ulcers").

combinations, and which may also to some extent pass over from one to another, may be arranged in the following groups:

(1) Niche formation.

(2) Narrowing, indrawing, pursing-up, sulcus or incisura formation, defect in the bulbar shadow, thus more or less pronounced *transverse* encroachments upon the lumen of the bulb.

(3) Loss of convexity, flattening, shortening, retraction of the bulbar outline, thus mainly *longitudinal* restrictions of the bulbar lumen.

(4) Pouch formation, saccular dilatation, diverticula.

(5) Annular, ridge and star formation (relief deformities).

(1) The Ulcer Niche. The ulcer niche, produced by the opaque substance forcing its way into and filling out the pit-like defect or crater-formed depression in the wall brought about by the ulcer, is thus the direct roentgenological sign of loss of substance in the duodenal wall occasioned by the ulcer. Both from a theoretical and practical point of view the niche is not only the most important but also the most reliable and frequent direct sign of ulcer.

In many cases both experienced and modern authors, and undoubtedly also a great number of practicing radiologists still maintain that the presence of a niche in a case of duodenal ulcer is a fairly great rarity and that it lacks any great practical importance. Nothing can be more erroneous and such a view marks the technique employed in the individual case as both unsatisfactory and unreliable.

In my first tabulated account of any larger compass (1921, about 100 cases) of definite duodenal ulcers the niche was

present in more than 60 per cent.[6] These 60 cases, at least, of niche formation had been collected in two years. After another two years (1923) the cases of niche formation observed by me had increased to about 250 and at present (1930) they greatly exceed a thousand. With the present routine compression technique, I estimate that of my cases of duodenal ulcer definitely established radiologically, roughly 75 per cent at least have at one time or another given evidence of niche formation. For long periods, especially in the spring and autumn it is not now unusual for me to see on an average one or two niche cases of duodenal ulcer daily, while in the same material I come across perhaps one niche of the stomach every or every other week. I had the pleasure of seeing my view about the great frequency and eminent importance of the niche in cases of duodenal ulcer fully confirmed in 1926 by H. H. Berg in a large number of cases and also subsequently by other authors.

The anatomical *cause* of the niche is seldom a penetrating ulcer (such are on the whole rare in duodenal cases, Fig. 19), but more often a callous or indurated ulcer situated in the duodenal wall itself. A less common although by no means rare phenomenon is to find a clear niche formation roentgenologically in cases of more recent non-indurated ulcers even when on exploration no demonstrable changes of the outer side of the intestinal wall either on inspection or palpation are found. One would wish that surgeons always kept this fact in mind. In one or two exceptional cases I have also come across, as an anatomical cause of a niche formation in the bulb, an epithelialized pit-like depression in the duodenal wall persisting after the cure of the ulcer.

The *size* of the bulbar niche varies

Fig. 32. Man, aged thirty-seven, with ulcer symptoms of many years' standing, at first for brief periods, lately more persistent. "Kissing ulcers" of more unusual localization, larger of two on lateral, smaller of them on medial bulbar circumference.

considerably. The largest I have seen were the size of half a walnut and the smallest the size of a millet seed, or even punctiform.

level of the opaque contents of the niche appear in contrast to the non-opaque fluid above.

Fig. 33.

The *shape* varies in profile from a semisphere to more the appearance of a nipple, tap, tent or thorn. On a frontal view the niche has generally a rounded appearance, sometimes more elongated; not unusual, particularly on compression roentgenograms, are the angular forms, the three, four or many-cornered, jagged or star-shaped forms with the corners often extending into the sulci between the folds of mucous membrane surrounding the niche (Fig. 20).

Particularly on compression roentgenograms, but also on others, the niches are usually found to be *denser* than the rest of the opaque shadow. *Gas bubbles* and a *three-layer separation* of the contents do not commonly occur; such phenomena, however, need not imply penetration but occur in purely intramural niches in the same way as the more common *horizontal*

The bulbar niches are usually *localized* in the basal half of the bulb; within this area they are most common at a certain distance from the pylorus and are less frequently met with at the pylorus itself and its immediate surroundings. The niches are also quite rare in the distal half of the bulb and more so the farther away one goes from the pylorus. Regarding the localization of the bulbar niches it is further true that they are decidedly more common in that half of the bulbar circumference that belongs to the area of the lesser curvature, thus within the medial respectively upper or left half, than within the lower or right half which belongs to the area of the major curvature. On the other hand I have been unable to find any preponderance in favor of the anterior or posterior wall of the bulb.

It is, of course, quite clear that the niches

which in a certain projection appear as "profile" or contour niches, in another projection more or less at right angles to the first, appear as "en-face" niches or vice versa. The terms "profile" and "en-face" niches thus convey nothing in themselves as regards the localization of the niche on the circumference of the bulb; for an exact localization attention must also be paid to the direction of the projection employed (Figs. 21–24). In the case of an "en-face" niche being found one should always, if possible, try to get a free-projected view of it; in other words, by altering the projection one should place the niche in profile, thereby ascertaining its position on the circumference of the bulb.

Fig. 34.

Figs. 33, 34. Woman, aged twenty-seven. Periodical symptoms of ulcer of many years' standing, this time for a month. Compression roentgenogram (Fig. 33) shows an en-face niche, size of a pea, with surrounding infiltrated ridge. Otherwise no deformity. After treatment there only remains a slight part of the niche (Fig. 34).

It is not so rare that, particularly in chronic callous cases, a niche formation on the anterior or posterior wall of the bulb (mainly on account of cicatrization in the bulbar wall itself or in its suspensory ligament) appears in a pure sagittal projection in profile on the lesser curvature aspect of the bulb or at least partly projects beyond this contour. It is generally possible, however, as has been rightly emphasized by Berg, to convince oneself by making a roentgenogram in the second oblique projection (see preceding) whether such a niche really belongs to the lesser curvature itself or whether it is part of the anterior or posterior bulbar wall.

It happens not infrequently that by this technique of projection and compression *double* or *multiple* niches can be demonstrated in the bulb. In the case of *multiple niches* one of them is generally found to be larger, deeper, of older date and more indurated; it, so to speak, puts its mark on the whole type of deformity and attracts the interest of the examiner. The presence of an ulcer of larger size often prevents

simultaneous ulcers of a smaller and more superficial type from making themselves apparent in the ordinary characteristic manner so that they may be diagnosed. Also the films may readily become so complicated that one must often be contented with assuming the presence of one or several ulcers of smaller size, as well as the larger one. In such a case a definite establishment of multiple ulcers is of course of no great importance from a practical therapeutical point of view. In other cases where the niches are more of the same size it is not unusual to be able to demonstrate several niches, especially when employing a good compression technique. In several instances I have managed to demonstrate both three and four simultaneous niches (Fig. 25). The *double ulcers* of Moynihan's type, the "kissing ulcers," the contact ulcers, are relatively easy to bring out on account of their characteristic position. The "en-face" niche appearing in a sagittal projection proves on oblique projection to be a combination of two niches projected one above the other, and in the second oblique projection one of the niches is found to belong to the anterior and the other to the posterior bulbar wall (Figs. 26–32).

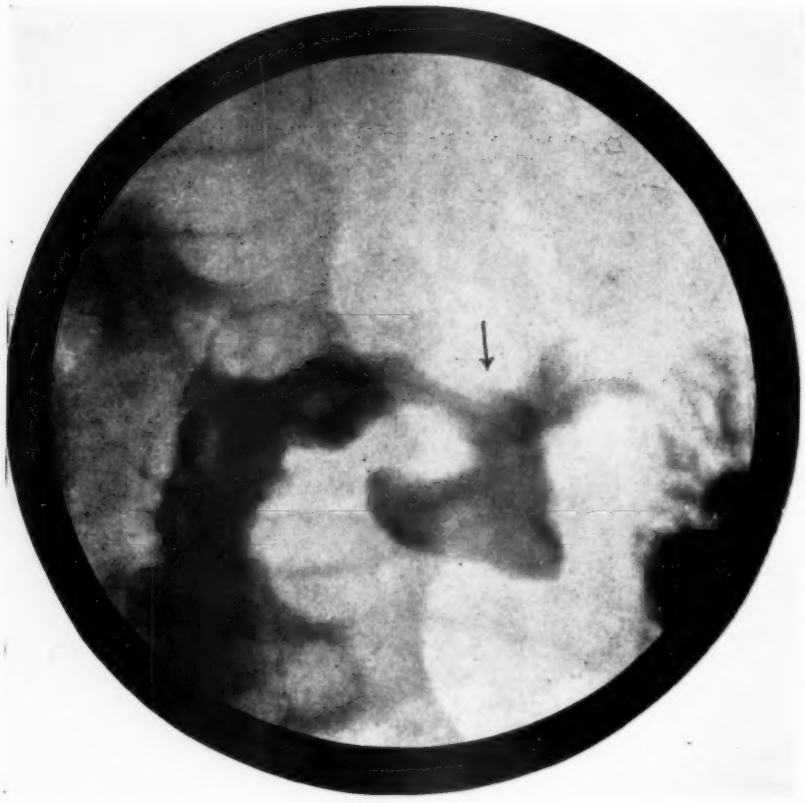


Fig. 35.

Under roentgen control by periodic examinations, e.g., in the course of medical treatment, the niches prove to undergo fairly rapid *changes in size*. As a rule during a cure a niche diminishes considerably or perhaps entirely disappears. It is often quite astonishing to see a niche about the size of a pea nearly entirely disappear in a couple of weeks. Routine control examinations of the results of medical treatment would seem well justified (Figs. 33–36).

Before leaving the niche as a sign of ulcer a few words should be said about the factors that may prevent the niche from appearing in the case of smaller ulcers. The ulcer may be covered by thick folds of mucous membrane; deposits of mucoid material, blood clots and food debris may

fill out a shallow ulcer crater and thereby prevent the opaque fluid from entering it. According to Berg the local swelling of the mucous membrane usually surrounding the ulcer is not present in individuals who have lost a great amount of blood, as a result perhaps of the blood-letting effect on the ulcer (this question will be dealt with later on); on that account it is rendered very difficult or even impossible to demonstrate these ulcers, so often fairly superficial and recent.

It practically never happens that a niche formation occurs isolated in an ulcer deformity but it is nearly always combined with one or several of the other configuration components which may take part in such an ulcer deformity and to which we will now pass on.

Fig. 36.

Figs. 35, 36. Married woman, aged forty-six. Abdominal symptoms for many years. Oval-shaped en-face niche, size of a hazelnut, with deep defects from all sides (Fig. 35). After cure there only remains a niche, size of a linseed, only visible on films exposed with spiral diaphragm compressor (Fig. 36).

(*To be Concluded*)

CHYLOTHORAX AND CHYLOUS ASCITES*

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AT the outset an apology must be made for the title for I realize that chylothorax and chylous ascites are manifestations and not a disease entity.

The case which forms the basis of this report presented so many interesting features that I felt that it would be worthy of a separate report. It is true that chylothorax and chylous ascites are only manifestations of an obstructive phenomena, but sufficient emphasis could not be laid on the significance of these phenomena if the case were reported in a group with other tumor cases where retroperitoneal and thoracic lymph structures are involved. This latter will be done in a subsequent presentation.

For the purpose of argument a summary of the case will be presented first and a detailed report later in the paper.

The patient in question was a woman forty-six years of age who first noticed an enlargement of the glands in her neck one year before she came under our observation. During the next twelve months the axillary, inguinal and epitrochlear glands successively became enlarged. The glands' masses were discrete and painless. The disease ran an irregular febrile course.

Because of her glandular involvement she consulted a doctor who gave her potassium iodide and neosalvarsan.

There was progressive loss of weight, digestive disturbances, orthopnea, nausea and vomiting, progressive enlargement of the abdomen and extreme weakness.

At the first examination a diagnosis of Hodgkin's disease was suggested.

The patient was admitted to Touro Infirmary for diagnostic study. The blood Wassermann test proved to be negative. Other blood examinations revealed a secondary anemia, without a leucocytosis and without a marked variation from the normal differential leucocyte count.

So far the findings seemed to eliminate lymphatic leucemia, tuberculosis and syphilis.

A biopsy was done and the report came back lymphoblastoma not characteristic of Hodgkin's disease.

As the condition progressed it was necessary to do a paracentesis and thoracentesis. The fluid removed from the chest was of a milky consistency and the analysis of this showed it to contain about 1 per cent of fat.

The finding of what seemed to be chyle in both the abdomen and the pleura increased the interest in the case. This prompted an investigation of the literature to see if I could find similar cases and if possible have some light thrown upon the etiologic factors in such a case.

Many interesting studies have been made of chylous ascites and chylothorax. It will not be necessary to review in detail all of them, but due credit should be given to the splendid review which was made by Handman, who in 1899 reviewed the literature up to that time. He was only able to collect 41 cases in the literature over a period of 260 years preceding.

Shaw, in 1900, reviewed the literature again and attempted to classify the cases which he had collected up to that time. He found that the cases immediately divided themselves into two groups, those in which the effusion was chyle and those in which the effusion was chyliform. In cases in which there was a true chylous ascites and chylothorax the conditions found were either obstructive in character or associated with external violence which had produced an injury to the thoracic duct.

In 1907 George Dock presented a case in great detail. Those interested in the subject will do well to read the original report.

In 1913 Sale reviewed the literature. In 1916 Tuley and Graves reported a case

* Submitted for publication August 9, 1930.

which in all respects is identical with ours, and expressed the opinion that obstruction of the duct, and inadequate collateral circulation result in dilatation of the duct and its radicals which is followed by an escape of chlye, by transudation, into the serous cavities.

When one considers the number of retroperitoneal masses and other abdominal tumors, as well as mediastinal growths, it is surprising to note how few of these cases are associated with sufficient pressure on the thoracic duct to cause a transudation of chyle into the serous cavities.

Lediard in 1913 presented a report on cases of chyliform effusion.

Lewin after presenting his case concluded that the diagnosis could only be made with the aid of the exploring needle or by postmortem examination.

I think all of the evidence accumulated in the literature as well as this personal observation confirms the observation of Lewin.

It is easy to understand the progressive emaciation when one notes the rapid reaccumulation of chyle in the serous cavities after its removal.

From a study of the cases reported it is clear that no form of treatment so far devised can possibly overcome the obstructive phenomena. Apparently the only hope lies in the direction of some form of treatment which will cause regressive changes in the tumor masses producing the obstruction of the thoracic duct. Thus far neither radium nor *x*-ray has succeeded.

The changes noted in the hip joint are of interest because I have not been able to find similar changes reported in the literature. In Hodgkin's disease there are several reported cases where an osteosclerosis, myeloid in character, has been found. This and one other case which will be included in a report on retroperitoneal malignant lymphomata, are the only instances where a destructive process involving the hip joint has been found in my experience. It is mentioned here that under similar circumstances others may find it of diagnostic value.

CASE REPORT

Miss F. A., aged forty-six years. Entered Touro Infirmary June 4, 1924. Provisional

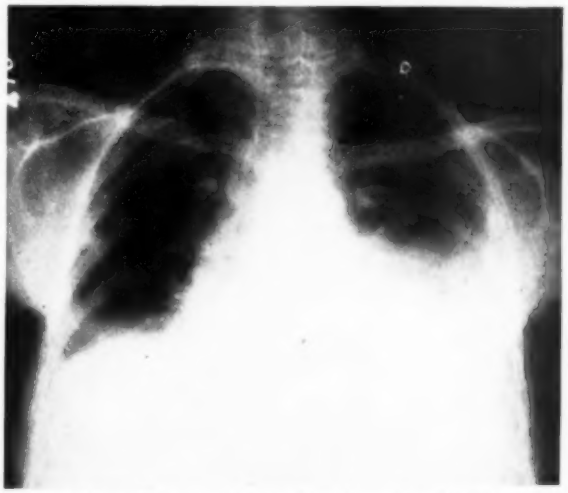

Fig. 1. Chest. Retroperitoneal and mediastinal lymphosarcoma with sarcoma of spleen.

diagnosis: Hodgkin's disease. Final diagnosis: Malignant lymphoma of retroperitoneal glands, mediastinal glands, obstruction of thoracic duct, metastatic lymphoma, spleen, liver and kidney.

Family History: Father died of cancer of stomach; Mother, senility. The family history is otherwise negative for cancer, and there is no history of tuberculosis in the family.

Personal History: There is nothing in her personal history which is pertinent to the present condition.

Present Illness: Her present illness began about June, 1923, at which time she noticed that the glands in one side of her neck began to enlarge. During August, 1923, the axilliary glands became noticeably enlarged. The cervical glands gradually increased in size until January, 1924, at which time the patient says the glands were about the size of a goose's egg; they were not painful.

During May, 1924 the inguinal glands became enlarged and just prior to her coming under our observation the epitrochlear became enlarged.

A few days ago the patient noticed a swelling under her tongue (she referred to the enlargement in the submental region). She complained very soon after the enlargement in her neck was noticed of a pain in her left hip.

The patient has recently noticed digestive disturbances, particularly a sense of fullness or

pressure in the upper abdomen which would last for two or three hours. She did not complain of eructations unless she would take

Fig. 2. X-ray of hip.

medicine. Orthopnea was a prominent manifestation after eating. The loss of weight has been rapid and progressive. When she first became ill her weight was 145 lb.; recently patient says that she has lost about 25 lb. in one week. Her present weight is between 90 and 100 lb.

The patient has had an irregular febrile reaction for some time. There has been progressive enlargement of the abdomen during the past three or four weeks. Weakness has been extreme recently.

Physical Examination: The patient shows a normal skeletal development, but she is emaciated and gives the appearance of being very ill. Her skin is warm, dry and loose, evidence of great loss of subcutaneous fat.

The pupils are equal, react equally to light and accommodation. There is no discoloration of the sclera. Her breath is foul and her teeth show marked decay.

Neck: Cervical glands enlarged. Posterior auricular and submental glands are markedly enlarged and they vary in size from about ¼ in. to 2½ to 3 in. The skin is freely movable over the glands and there is no evidence of recent inflammatory changes in the skin. Most of the glands are discrete, although some of them give evidence of some matting together. The pulsations in both sides of the neck are marked.

Chest: Chest is well developed, but markedly emaciated as the supraclavicular fossae, suprasternal notch, clavicles and ribs are very prominent. The scapulae look almost like winged scapulae. There is marked atrophy of the breasts.

There is dullness on percussion in the right and left apices, as well as in the right and left axillae. There is hyperresonance anteriorly below the clavicles. There is an absence of breath sounds below the axillary fold on both sides. Bronchial breathing posterior to the inferior angle of the scapulae. There is marked bronchovascular breathing over the right and left apices.

Heart: Soft systolic murmur in mitral area which is not transmitted. I am unable to percuss heart. The sounds are weak, rapid, but there is no irregularity.

Abdomen shows marked distention. Skin is glossy. The umbilicus is pushed out. No tumor masses are palpable. There is a shifting area of dullness and transmission of fluid noticed three fingers below the umbilicus. The spleen is palpable well below the umbilicus and it has a nodular feel.

Extremities: Edema of both feet, particularly marked on the left side.

Blood examination showed secondary anemia with a normal total white count and a differential white count which did not differ from the normal. Total white 8250. Total red, 2,925,000. Hemoglobin 45 per cent.

Wassermann test is negative.

X-ray examination of the chest, left hip and right tibia, was made. The *x*-ray report is as follows: "Fluoroscopic and radiographic examination of the chest shows the diaphragm high on the left side with some opacity, and a thickness of the pleura. The heart shadow is slightly pushed to the right with an enlargement of the heart to the right and left. The radiograph shows evidence of a thickened pleura on the left, with some possible effusion. The liver is enlarged upward. The fibula on the right shows some periosteal changes. *The left hip joint shows a destruction of the lower end of the hip joint which is quite extensive.*

Radiographic examination of the right hip joint shows no evidence of abnormality" (Drs. Samuel and Bowie).

specimen of the ascitic fluid was sent to the laboratory for examination, particularly for a cell count and staining of a centrifuged speci-

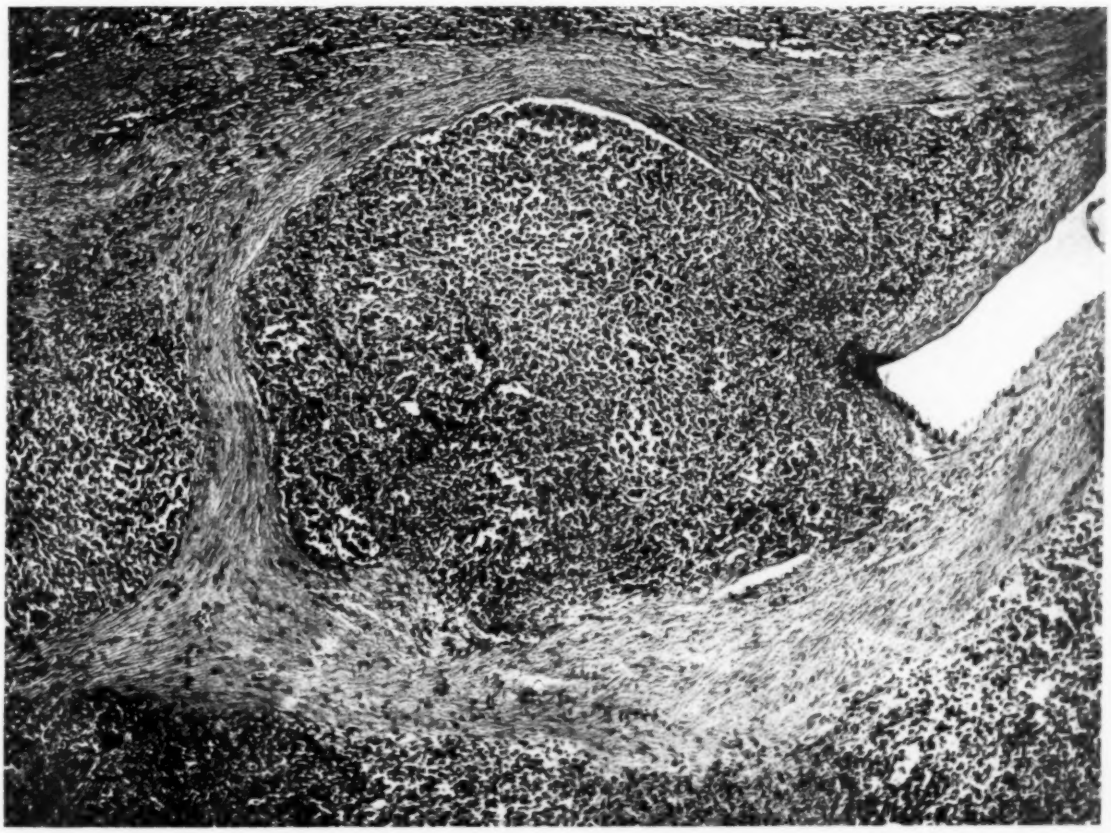

Fig. 3. Photomicrograph of section of retroperitoneal lymph node. Reported by Dr. James Ewing as lymphosarcoma.

Examination of the urine revealed specific gravity 1.029; negative for albumin, sugar, acetone. Microscopic examination revealed a few pus cells, also epithelial cells.

Under local anesthesia a biopsy was done. The laboratory findings as reported by Lanford are as follows: "Oval gland measuring about 2 cm. in its greatest diameter. Outer surface somewhat rough, pink in color, covered by a capsule. On section cut surface presents a glistening pinkish appearance. It is soft in consistency, fairly cellular in character. Diagnosis: Lymphoblastoma not characteristic of Hodgkin's disease."

Because we believed that we were dealing with Hodgkin's disease, deep *x*-ray therapy was started on June 5. During the past few years I have used radium in Hodgkin's disease by preference.

On June 7 paracentesis was done and we obtained about 4000 c.c. of a serous fluid. A men. No bacteria could be found in the fluid. A differential count showed 74 per cent small lymphocytes, large mononuclear leucocytes 23, neutrophils 3.

Following the paracentesis the liver was palpable as far as the anterior superior spine of the ileum. The surface of the liver was nodular.

During the next few days the patient developed a diarrhea, but nothing unusual was noted about the stools.

There was a progressive and rapid refilling of the abdomen. Because of this fact it was decided to see whether palliation would result from a Talma type of operation and therefore the following procedure was carried out on June 18, 1924.

Local Anesthesia. Right rectus incision about 1½ to 2 in. long. When the peritoneum was opened about three-fourths of a gallon of straw colored fluid was removed. The liver

was examined and nodules were seen on the surface. With the hand in the abdomen I attempted to find some omentum. The only thing which we did note by this examination was that no hollow viscera could be found; that the solid organs occupied the anterior portion of the abdominal cavity as far down as the pelvis. The liver had become adherent to the peritoneum on the right side just below the anterior, superior spine of the ileum, nature thus having formed an artificial hepatopexy. The spleen or liver (not able to say which) could be palpated on the left side as far down as the anterior superior spine of the ileum. Since we could neither see nor feel the omentum, we closed the abdomen with through and through silkworm gut sutures.

Postoperative diagnosis: Hodgkin's disease.

Pathological: Malignant lymphoma.

Patient made an uneventful recovery from the operation.

On July 7, blood count was made and two rather interesting phenomena were noted: a marked leucopenia and an increase in the total red.

On July 7, dyspnea was more marked, respiration rapid and shallow. The apex impulse was noted on the right, mesial to the nipple, about the fifth interspace. The veins in the midaxillary on the left side were about the size of a goose quill.

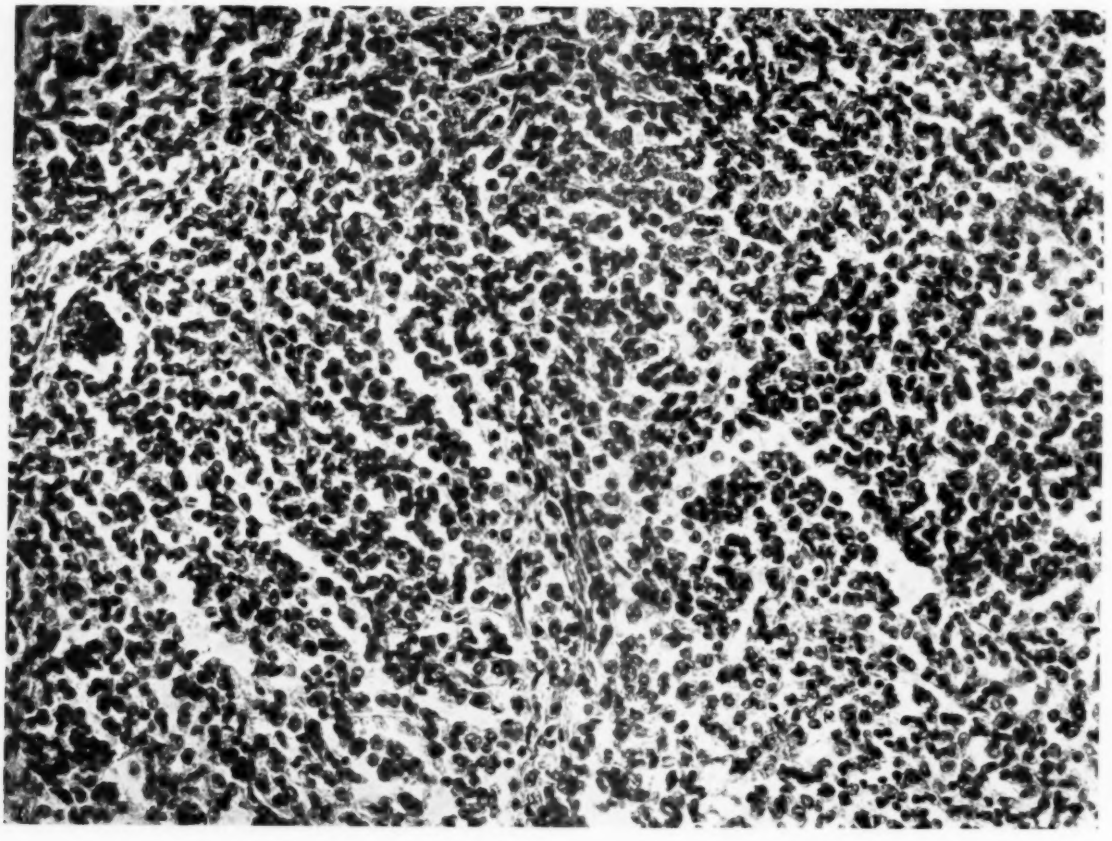

Fig. 4. High-power photomicrograph, same tissue. Lymphosarcoma.

The mass of glands in both axillae was larger than on previous examination. Dullness on the left side of chest from the second rib to base, anteriorly and posteriorly. There was bronchial breathing above the fourth rib, anteriorly. The voice sounds were indistinct below this level. The heart sounds were distant on the left, but were easily heard on the right side at the fifth interspace. Evidently the heart was displaced to the right by fluid in the left chest.

Abdominal examination showed that it was dome shaped; there was dullness over the entire abdomen. By paracentesis we obtained about 2000 c.c. of milky fluid. This fluid looked so much like chyle that tests for fat were made by Dr. Holladay, the interne on the service. The laboratory findings were as follows: Specific gravity 1.016; albumin 45 per cent;

non-protein nitrogen 19–8 mg. per 100 c.c.; fat (Babcock) less 1 per cent; urea nitrogen, 9.9 mg. per 100 c.c.; dextrose 110 mg. per 100 c.c.; sediment, many red cells (blood) found. No abnormal increase in white cells.

On July 8, thoracentesis was done on the left side and about 1375 c.c. of milky fluid obtained. Immediately following the thoracentesis the patient felt very much better, respiration was less embarrassed.

On July 11, three days later, because of the rapid reaccumulation, thoracentesis of left side was done; 1250 c.c. was obtained.

On July 15, paracentesis was done, 2000 c.c. of milky fluid removed from the abdomen.

On July 18, 1940 c.c. of milky fluid was obtained from chest.

On July 24, 2000 c.c. of milky fluid obtained.

On July 25, the patient's dyspnea was great and the abdomen seemed full. An attempt was made to do a paracentesis, but solid viscera seemed to act as a stopper and we were unable to obtain fluid.

On July 26, there was dullness of the entire left chest. Anteriorly and posteriorly voice sounds were distant. Apex beat on right to 1 in. mesial to right nipple. Heart sounds clear, regular. Glands: the masses in both sides of the neck have increased in size. They remain movable but in a definite chain extending from tip of mastoid nearly to clavicle. The masses in the axilla have increased in size. The lymphatics of the left side of chest wall leading to axillary group are enlarged and palpable for a distance of about 4 in.

On July 28, 1975 c.c. of milky fluid were obtained from the chest.

On July 31, 1000 c.c. aspirated from the left side of the chest.

On August 6, the right side of the chest was aspirated and about 500 c.c. of milky fluid obtained. At this time edema was noted in both lumbar regions. The glands in the right side of her neck were markedly increased in size, yet there was no evidence of a degeneration. There was, however, some fusion of the mass, but it was not adherent to the skin.

The blood picture on August 10 showed total white 6250; total red 2,070,000; platelets 290,300. Hemoglobin (Dare) 25 per cent.

By this time the patient was very weak; she complained of a great sense of tightness in the abdomen after eating. There was marked edema of both upper and lower extremities. The edema of the abdominal wall was progressing.

On August 26, the left pleural cavity was aspirated; about 1200 c.c. of milky fluid obtained. The mass in the neck, axilla and inguinal regions progressively increased in size. Her dyspnea increased, weakness was progressive and the only comfortable moments which the patient had during the interval between September 1 and her death on September 3 were obtained as a result of the use of morphine. Death came suddenly on September 3 when the patient attempted to support herself in bed.

An autopsy was done shortly after death by Dr. John Lanford, Pathologist at Touro Infirmary. An abstract of the autopsy findings is appended.

Post-mortem Record: Miss F. A., by Dr. Isidore Cohn, died September 3, 1924, 1:15 P.M.

Body is that of a white female, about 5 ft. in length. General nutrition fair. The skin is tense and shiny and edematous over the entire body with exception of the anterior surface of the arms, chest and face. Scattered over the lower abdomen are small petechial hemorrhages.

Palpation of the neck shows cervical nodes to be enlarged. There is a gland about the size of a pecan in the anterior cervical group on the right side. There are two large masses the size of a pigeon's egg in the posterior group. The veins of the neck are distended.

The thorax is of the long narrow type with deep intercostal spaces and prominent ribs. The axillary glands on the left side are enlarged, varying in size from a marble to a pigeon's egg and on the right side there is one the size of a hen's egg.

Abdomen is greatly distended, walls being very edematous. There is a scar on the right side of the abdomen.

Both lower extremities are edematous. The left showing small pin-point punctures from which serum is exuding.

Upon opening the abdominal cavity the wall is found thickened due to an extreme amount of edema. The abdominal cavity contained about 3000 c.c. of cloudy fluid. The omentum extends midway between the umbilicus and the symphysis pubis.

The liver extends 2 cm. below the costal margin on the right at the mid-clavicular line and 10 cm. below the zyphoid process

num shows a number of tumor masses replacing the lymph nodes.

The pericardial cavity contains about

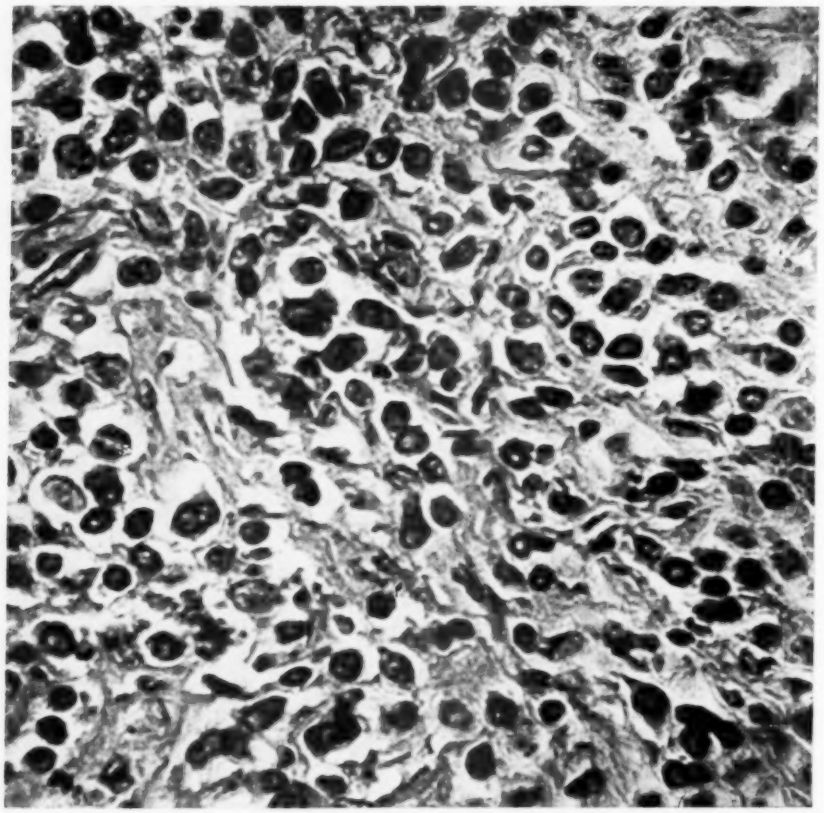

Fig. 5. Spleen from same case. Reported by Dr. John Lanford, lymphosarcoma; Dr. James Ewing, lymphosarcoma; by Dr. Clarence Cohn, lymphosarcoma, possibly Hodgkin's disease.

in the midsternal line. The spleen extends 2½ cm. below the costal border in the axillary line and in the left parasternal line. Diaphragm extends to the fifth interspace on the left side and to the fifth rib on the right side.

Pleural Cavity: On the opening the left pleural cavity is found to be filled with about 2 l. of reddish brown fluid. The left lung is completely collapsed and the parietal pleura is discolored. The right pleural cavity contains fluid similar in consistency and color but only about 500 c.c. The lung on this side is apparently normal in position and shape. There are a few nodules on the pleural surface of the diaphragm in the area of the midline. These nodules vary in size from a peat to a walnut. The first portion of the mediasti-

100 c.c. of straw colored (clear) fluid. The heart is displaced to the right, the apex being 1 in. to the left of the midline, the right side being dilated and the left contracted. Upon incising the heart, the outer surface is found to be pinkish brown in color, the epicardium is slightly edematous and the outline of the vessels prominent. The heart muscle is flabby and shows an increased amount of connective tissue running in distinct white cords through the brown muscle. The endocardium is free from acute or chronic inflammatory reaction. The valves are normal. The attached portion of the aorta shows a few early atheromatous placques.

Lungs: Upon removing the lungs the left one is found to be almost completely collapsed and uniform in consistency

throughout except the apices are slightly emphysematous. The right lung is crepitant with a few edematous areas but no evidence of new growth or pneumonia is found.

Liver: The liver is 20 cm. × 19 × 7 in dimension. The outer surface is rough, irregular, covered with recently organized adhesions. In addition there are a few elevations corresponding to the seat of newgrowths. These changes are mostly confined to the right lobe. The under surface presents a similar picture except that the exudate is more recent.

Spleen: The spleen measures 10 × 5 × 1 inches and is firm and uniform in consistency. The outer surface shows many adhesions. The color is mottled, varying from a dirty cream to purple. Upon sectioning it is found to offer increased resistance to the knife. The cut surface shows the normal tissue to be largely replaced by newgrowth and appears somewhat like a cross section of a bologna sausage, there being areas, light cream in color, irregular in outline, which are surrounded by deeply red zones of splenic pulp. The material does not easily scrape off with the knife.

Kidneys: The left kidney is smaller than normal. The right kidney is increased in size, firmer than the left and upon peeling back the capsule the outer surface is slightly granular and firm and pinkish nodules of a secondary growth are found.

The adrenals are free from evidence of new growth.

Retroperitoneal Lymph Nodes: The retroperitoneal lymph nodes are enlarged and matted together and upon following up the thoracic duct we find enlarged structures resembling tumor masses at intervals along its entire course which are pressing upon it, preventing free flow of fluid.

Pelvic Organs: The broad ligaments are filled with firm hard nodules, varying in size from a small pea to a pecan, which are secondary growths. The tubes present similar nodules. The uterus is also nodular, presenting secondary growths on its serous surface. The right and left ovaries are infiltrated with secondary growths.

Anatomical Diagnosis: Lymphosarcoma, primarily in the retroperitoneal lymph nodes with secondary metastasis to the lymph adenomatous structures of the entire body.

Secondary lymphosarcoma of the kidney.

Obstructed thoracic duct. Peritoneal chylous transudate. Pleural chylous transudate. Atelectasis of the left lung. General anasarca. Chronic nephritis, chronic proliferative peritonitis, Lymphosarcoma of spleen. (Lanford).

Specimens of the mediastinal gland and the spleen were submitted to Drs. James Ewing and Joseph Bloodgood. The following reports have been received.

Dr. Ewing reported:

> The case of retroperitoneal lymph nodes seems to me to fall in the group of lymphosarcoma. Definite features of Hodgkin's disease are not present, but as you know, in some cases of Hodgkin's, the process resembles sarcoma. This is probably one of those cases.
>
> In the section of spleen, I think the process is so cellular that it must be regarded as a splenic sarcoma arising from the reticulum cells of the follicles. Yet, Dr. Stewart, my colleague, thinks this is a case of Hodgkin's disease. I do not find the features of Hodgkin's disease, but again this may be Hodgkin's disease of sarcomatous type.
>
> I think this is a case of lymphosarcoma. Whether it arises on the basis of Hodgkin's disease, as Dr. Stewart thinks, I am unable to state, but I do not find any definite lesions of Hodgkin's disease.

The following report was received from Dr. L. Clarence Cohn, associate of Dr. Bloodgood who kindly examined the specimen for me in Dr. Bloodgood's absence:

> The section from the gland shows a lymph gland in which there is no germinal center. The gland is very cellular and there is a great deal less stroma than we usually see in Hodgkin's disease. It is more like the gland of lymphosarcoma. Nevertheless there are so many large cells with multiple nuclei suggesting Dorothy Reed cells that I would be more inclined to think of Hodgkin's disease than lymphosarcoma. Section from the spleen shows pretty much the same picture except perhaps

there is a little more stroma and not so many of the large multinucleated cells. Nevertheless they are present.

SUMMARY

1. This patient presented progressive involvement of all of the superficial lymph nodes.

2. Obstructive phenomena were present. About 12,000 c.c. of chylous fluid were removed from the chest at various times.

3. At autopsy we found enlarged mediastinal lymph nodes which obstructed the thoracic duct. The spleen was markedly enlarged and presented the appearance of a cross section of a Bologna sausage.

4. The clinical syndrome was confused with Hodgkin's disease.

5. The difficulties in diagnosis are evidenced by the differences in opinion expressed by the pathologists who have examined the specimens.

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*Continued from p. 232.

HISTOLOGIC STUDIES OF THE THYROID GLAND. I.*

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NEW YORK CITY

SINCE the question frequently arises as to what constitutes normal and abnormal thyroid tissue, we have obtained for study sections from people whose deaths were due to accidental causes. These patients vary in age from still-births to eighty-nine years. As a means of comparison there are also sections from people who died from acute and chronic diseases. This work began in April, 1929, and through the courtesy of Dr. Charles Norris, Chief Medical Examiner of New York; Dr. Douglas Symmers, Director of Laboratories, Bellevue Hospital, and the House Staff of the Fourth Surgical Division, we were able to obtain the material.

On January 1, 1930 we had studied sections from 107 cases. It has been our intention to get sections on a large series of cases, rather than serial sections on a few cases, as these would represent more nearly the pathological reports that are received from operative specimens. So far there have been 80 cases of accidental death from which sections of the thyroid have been studied. There are also 27 cases of patients who died from some systemic disease and it was thought best to divide them into two groups. 1. Acute diseases, any case of a patient dying in less than three weeks from the onset of the disease. 2. Chronic diseases, those extending over months or years. There was 16 deaths due to acute diseases but the sections in this group failed to reveal any definite histological changes. There were 2 patients who died from chronic diseases and we have been unable to find any striking changes produced in the thyroid in this group.

To have a working basis for normal thyroid tissue Figure 1 is a reproduction from Piersol's[1] histology which represents the acini of a relatively uniform size and containing colloid. There is also connective tissue dividing the gland into lobules, as well as interacinal connective tissue. In a recent editorial[2] the author states, "The normal gland contains a relatively large proportion of small follicles, but these contain colloid. Undifferentiated follicles or interfollicular cell groups like those described by Wolfert were not observed in serial sections of either the normal or hyperplastic organ." The picture presented by Piersol and the opinion expressed in the recent editorial seem to coincide.

This work has been divided into 6 groups. Group 1. Still-births. Group 2. Infants from birth to two years. Group 3. Children from two to twelve years. Group 4. Adolescents from twelve to eighteen years. Group 5. Adults from eighteen to sixty years. Group 6. Beginning senility, from sixty years up.

GROUP 1. In the study of the 9 cases in this group the microscopical sections revealed the gland divided into lobules with the epithelial cells closely spaced and interstitial tissue absent. Occasionally there could be seen a developing acinus but without colloid material. Figure 2, female, still-birth, due to cranial injuries, reveals the gland divided into lobules by connective tissue. The lobules present an occasional developing acinus but are made up chiefly of closely spaced epithelial cells. Figure 3, male, still-birth due to breech extraction, reveals similar findings to those in the former section. Figure 4, male, still-birth, due to cranial injuries, presents a picture similar to these sections. All the sections of this group present a uniform picture, as illustrated.

GROUP 2. There were 8 cases in this group but the sections did not present uniform pictures. Figure 5, male, two days,

[1] PIERSOL, G. A. Normal Histology. Ed. 10, Phila., Lippincott, 1927.

[2] Editorial. Structure of the thyroid gland. *J. A. M. A.* 94: No. 8, 1930.

* Read before the American Association of Pathologists and Bacteriologists, April 18, 1930, New York City.

died from congenital anomaly of heart. This section presents some developing acini but it contains chiefly undifferentiated epithelial cells similar to the fetal group. Figure 6, female, eight weeks, died from pneumonia. This section shows numerous formed acini containing colloid and other areas with undifferentiated epithelial cells. The connective tissue divides the gland into lobules and the interacinal connective tissue is very pronounced. This does not coincide with Hertzler's[1] view as he states "The amount of connective tissue of the septa varies according to the age of the individual, there being a marked increase in advanced years of life. This is particularly noticeable in individuals past fifty years of age when the acinal cells tend to decrease in size." Figure 7, female, four months, cause of death, dehydration. This is quite similar to the sections in the fetal group, representing chiefly masses of undifferentiated

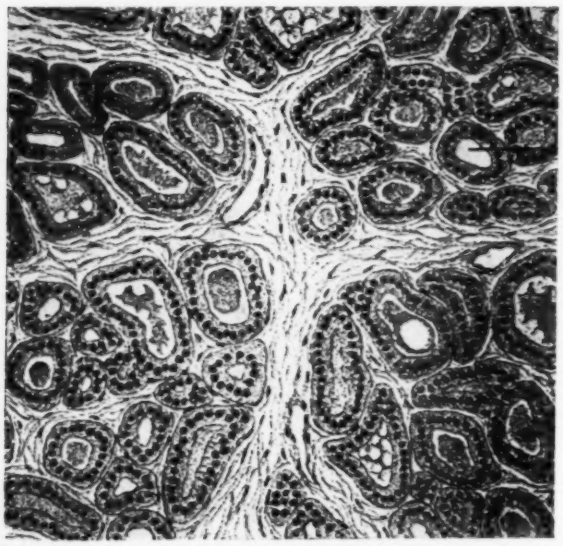

FIG. 1. Acini of relatively uniform size and containing colloid. (From Piersol's Histology.)

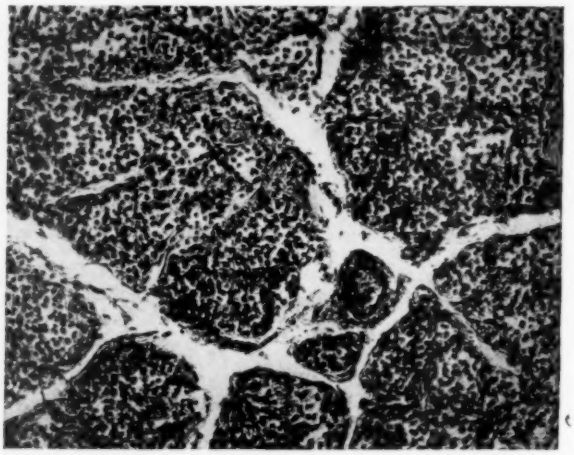

FIG. 2. Female, still-birth, due to cranial injuries.

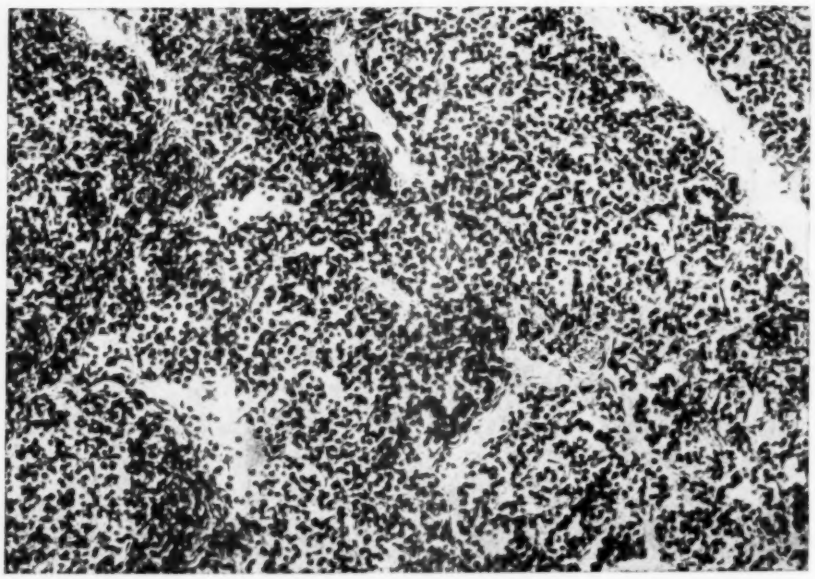

FIG. 3.

[1] HERTZLER, A. E., Diseases of the Thyroid Gland. Ed. 2, St. Louis, Mosby, 1929, pp. 27, 29, 33, 34, 39.

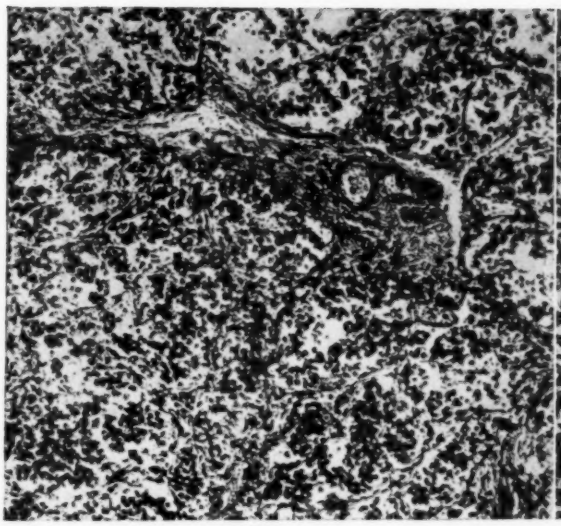

FIG. 4.

FIGS. 3 and 4. Male, still-birth, due to breech extraction.

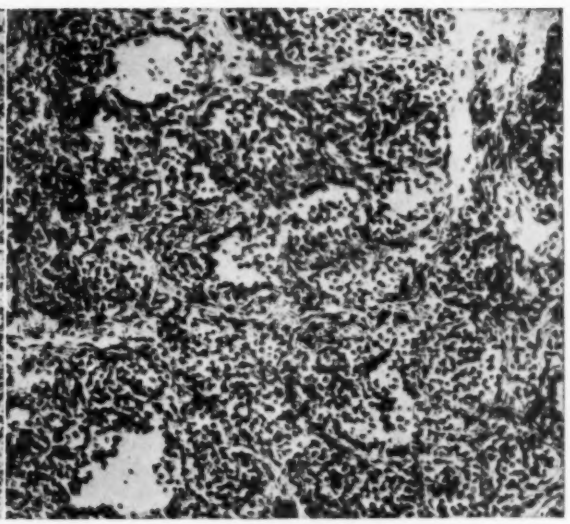

FIG. 5. Male, two days old, died from congenital anomaly of heart.

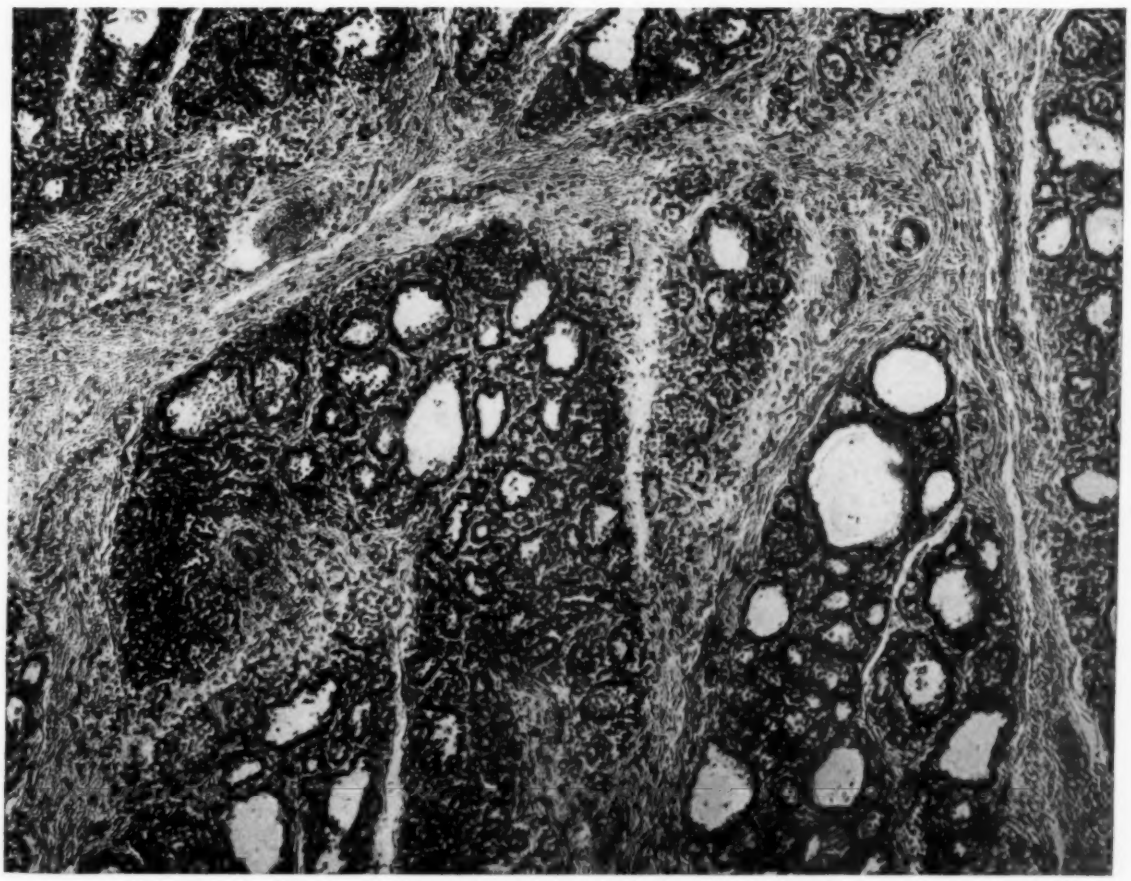

FIG. 6. Female, eight weeks old, died from pneumonia.

epithelium. Figure 8, male, ten weeks, died from pneumonia. This again reveals well developed acini which contain colloid with

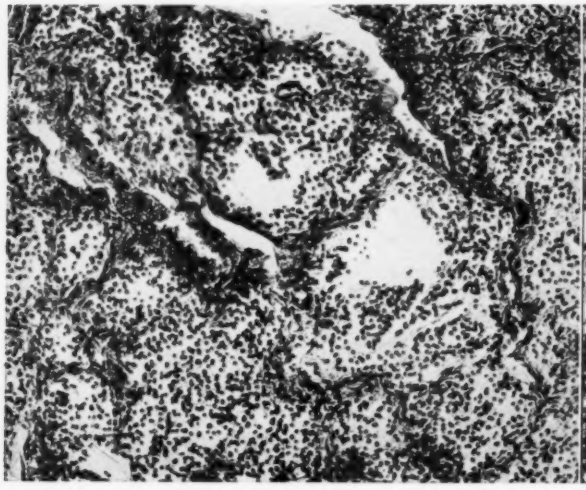

Fig. 7. Female, four months old, cause of death dehydration.

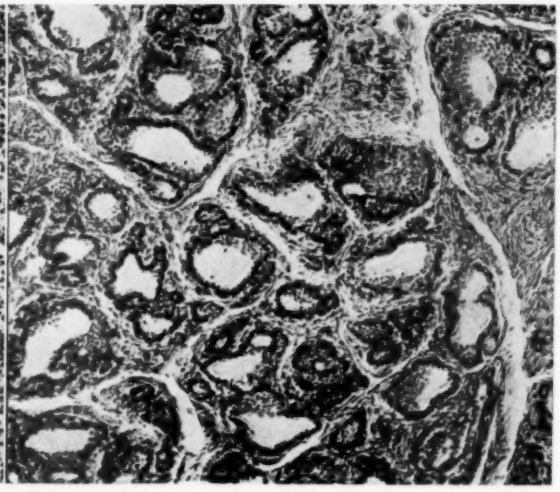

Fig. 8. Male, ten weeks old, died from pneumonia.

interacinal connective tissue, even more pronounced than in Figure 6.

Group 3. The sections of the 12 cases in this group revealed marked variation. Figure 9, female, three, died from tetany. This section is very characteristic of the fetal group with only occasional developed acinus. Figure 10, male, five, died from a ruptured spleen. This section revealed a few formed acini but made up chiefly of closely spaced epithelial cells. Figure 11, male, five years, died from a fractured skull. This revealed connective tissue dividing the gland into lobules with numerous epithelial cells and developing acini. Figure 12, male, six years, died during ether anesthesia for an adenoid and tonsil operation. There were several well developed acini containing colloid with some undifferentiated epithelial cells. The interlobular and interacinal connective tissue is very pronounced. Figure 13, male, six years, died from a fractured skull. There were some formed and developing acini but made up chiefly of undeveloped epithelium quite characteristic of the fetal type.

Group 4. There were only 7 sections falling in this group. Figure 14, male, thirteen years, died from a fractured skull. There were well developed acini distended with colloid and a few areas of undifferentiated epithelium. Some acini contained vacuoles. Figure 15, male, twelve years, died from acute articular rheumatism with decompensated heart. There were numerous well developed acini distended with

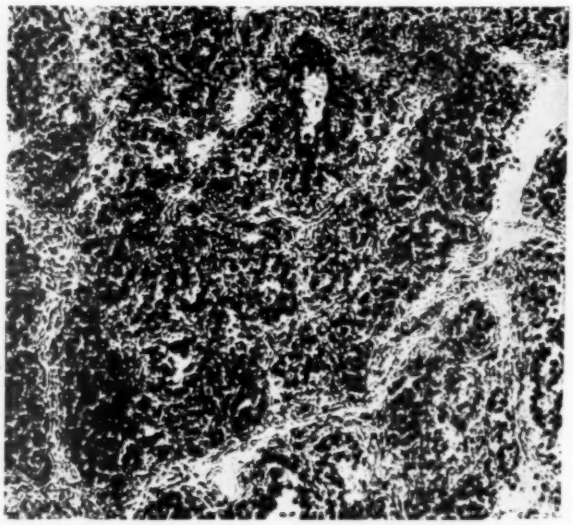

Fig. 9. Female, three (years (?) old), died from tetany.

colloid, and a moderate amount of interstitial tissue in this section.

Group 5. In this group it would seem that we should have some uniformity in the histological picture. There were 60 cases falling in this group and the sections represented practically all stages in the

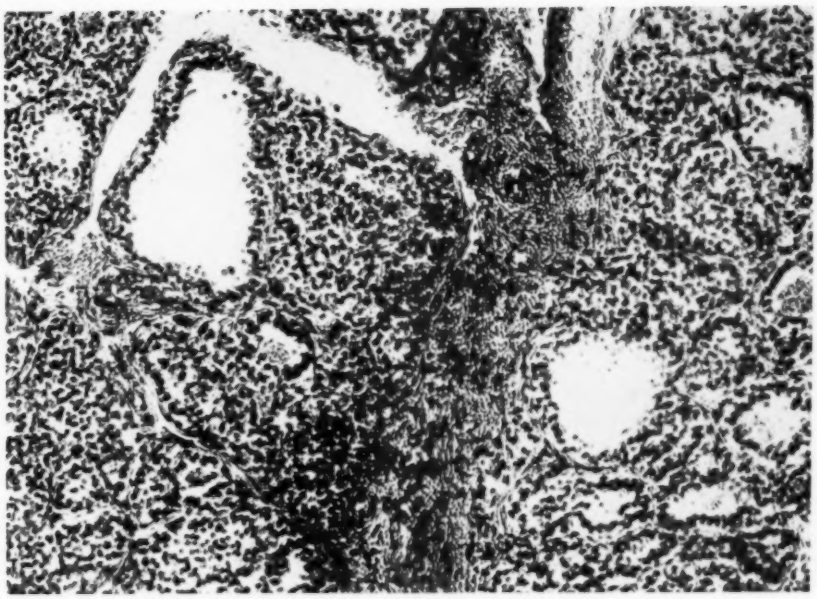

FIG. 10. Male, five, died from ruptured spleen.

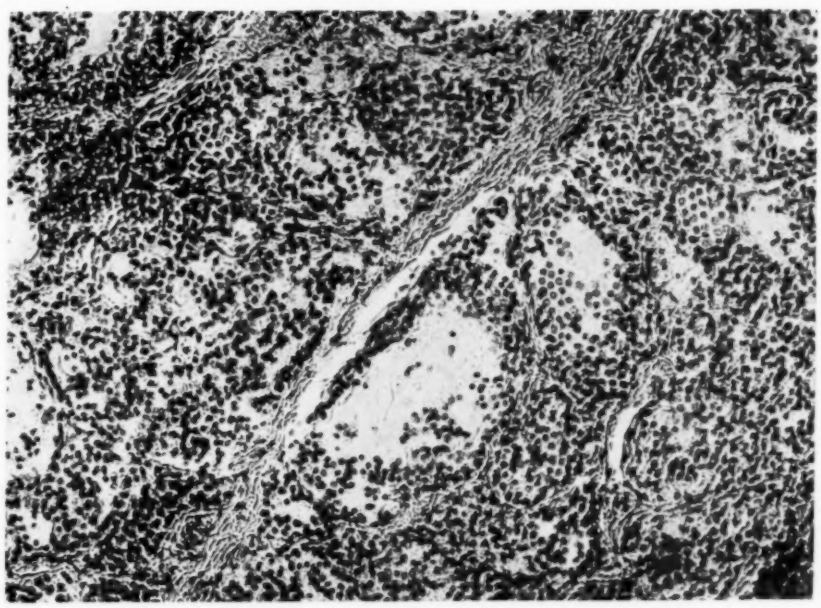

FIG. 11. Male, five years old, died from fractured skull.

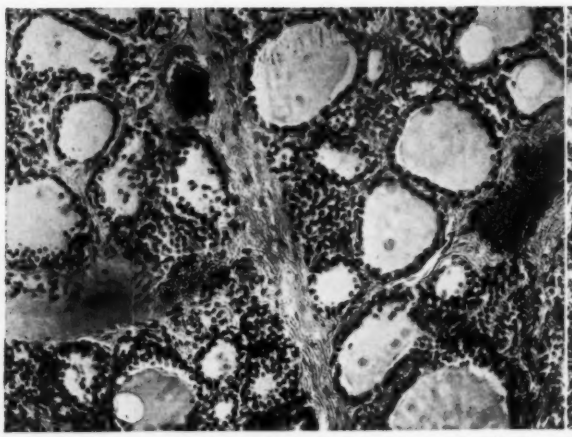

FIG. 12. Male, six years old, died during ether anesthesia for adenoid and tonsil operation.

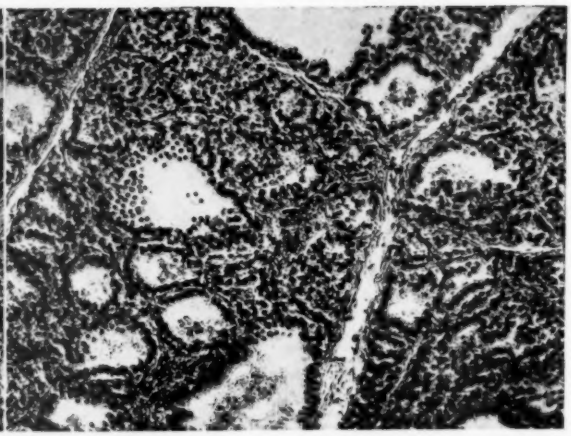

FIG. 13. Male, six years, died from fractured skull.

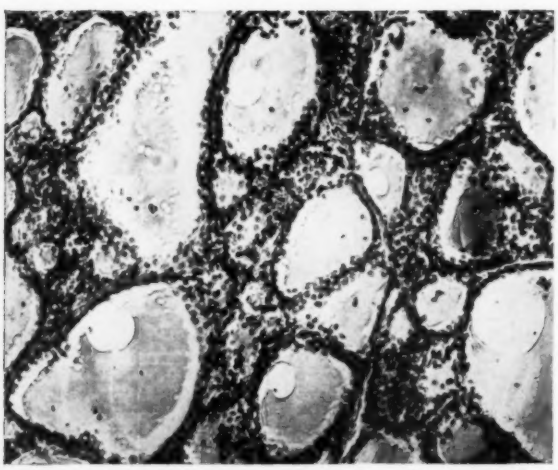

FIG. 14. Male, thirteen years, died from fractured skull.

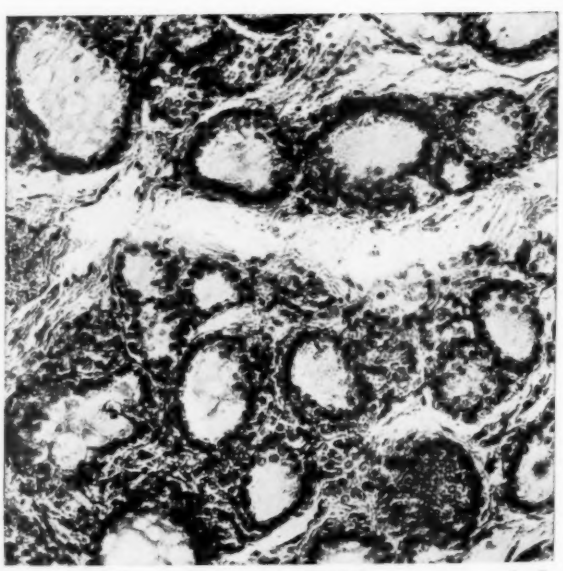

FIG. 15. Male, twelve years, died from acute articular rheumatism with decompensated heart.

growth and development of the thyroid from the fetal type in some instances to sections containing large dilated acini distended with colloid and lined by flat epithelium in others. Figure 16, male, twenty-five years, shot by police and instantly killed. Note the large distended acini full of colloid with very little interacinal connective tissue. Figure 17, female, thirty-five, died from a fractured skull. This section is quite characteristic of the fetal group with some small developing acini with a mass of undifferentiated epithelium and interlobular connective tissue. Figure 18, female, fifty-six, fractured skull. There are some well developed acini in this section and numerous undifferentiated epithelial cells. Note the absence of connective tissue. Figure 19, male, sixty years, fractured skull. Acini are well developed containing colloid with considerable interacinal connective tissue. Figure 20, male, twenty-six years, died under ether anesthesia. Diagnosis, status lymphaticus. This section might be considered a diseased thyroid but it contains numerous small acini without colloid and no connective tissue. Figure 21, male, forty-five, lobar pneumonia. There are some well formed acini but the section is made up chiefly of undifferentiated epithelial cells, with interlobular connective tissue. Figure 22, male, forty-eight years, lobar pneumonia. There are a few developed acini in this section, and there are other smaller acini with masses of undiffer-

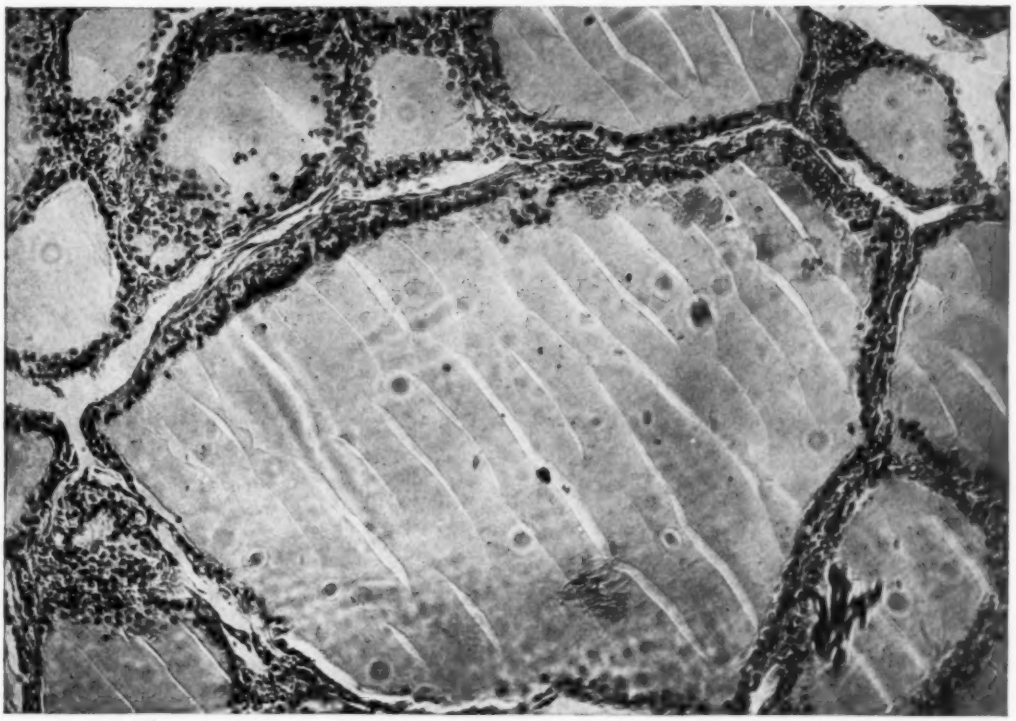

Fig. 16. Male, twenty-five years, shot by police and instantly killed.

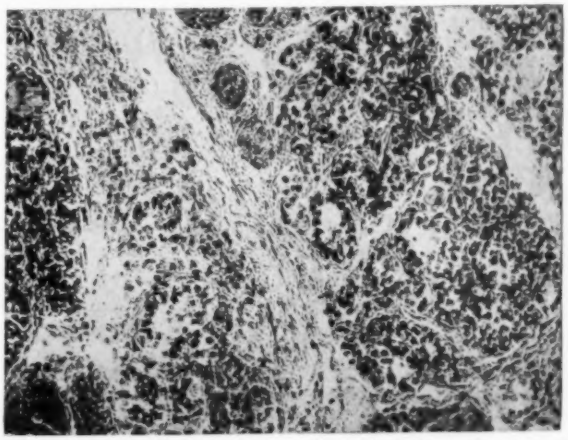

Fig. 17. Female, aged thirty-five, died from fractured skull.

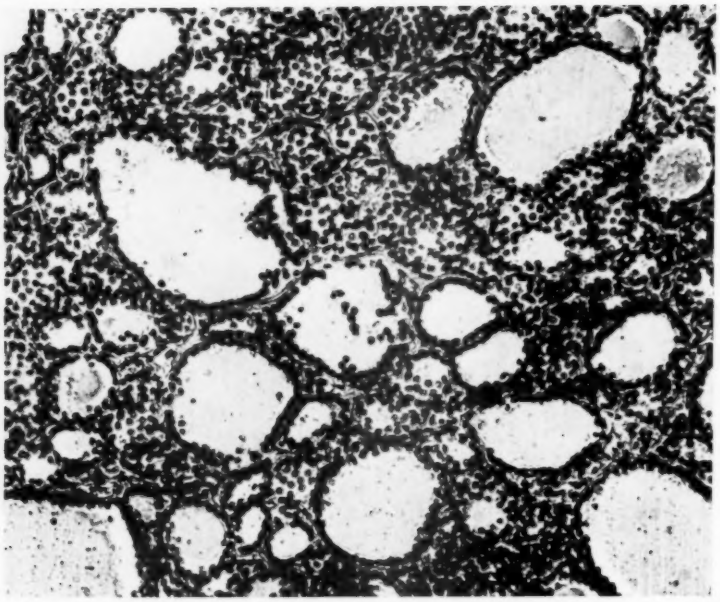

FIG. 18. Female, aged fifty-six, fractured skull.

FIG. 19. Male, sixty years, fractured skull.

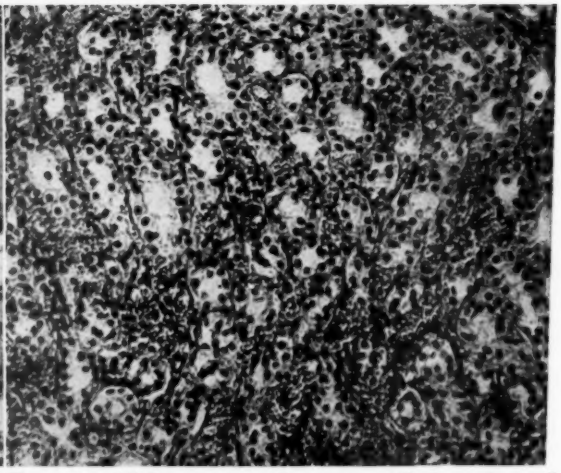

FIG. 20. Male, twenty-six years, died under ether anesthesia.

entiated epithelial cells. There is very little connective tissue. Figure 23, male, twenty-five years, died from tuberculous peritonitis. This is quite similar to the fetal type with only occasional developing acinus.

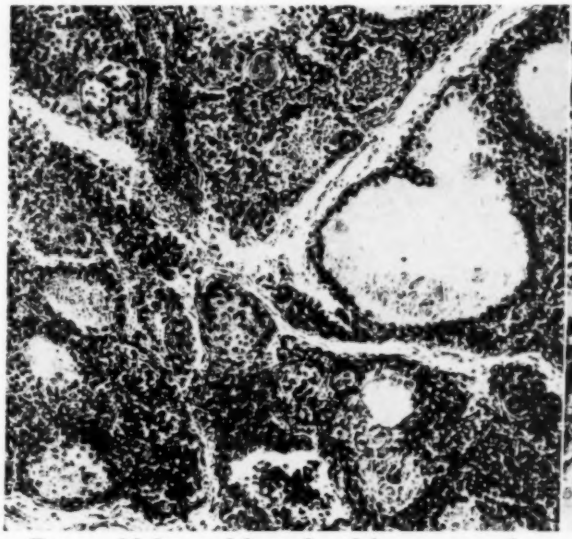

Fig. 21. Male, aged forty-five, lobar pneumonia.

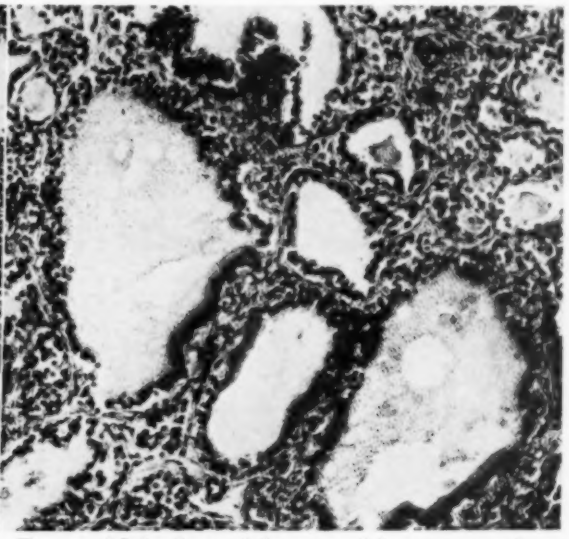

Fig. 22. Male, forty-eight years, lobar pneumonia.

Group 6. There were only 2 cases in this group and the histological picture is quite variable. Hertzler states that the "Acini in infants and children are smaller than in adults. The epithelium is taller in young subjects and the acini contain little or no colloid." Figure 24, male, seventy-five, died from a fractured skull and lacerated brain. There are some well formed acini and several smaller acini with other areas of undifferentiated epithelial cells. Note the connective tissue at the periphery dividing the gland into lobules. Figure 25, female, sixty-one, committed suicide by strangulation. This section is made up chiefly of undifferentiated epithelium with some small developing acini. There is very little connective tissue seen. Figure 26, female, eighty-three, ruptured appendix with abscess. There are 2 rather large acini containing colloid but the section is made up chiefly of very small acini and undifferentiated epithelium. There is practically no interacinal connective tissue.

It was stated in the beginning of this paper that sections were taken from people of various ages and a rather large group has been studied with the hope of finding a uniform histological picture for normal people of different ages. So far we have been unable to draw conclusions as to what is normal thyroid tissue for the different ages and must disagree with Hertzler[1] when he states "For practical purposes I am convinced that if one keeps in mind the various changes normal to the different periods of life as above indicated, the histology of the thyroid gland will be found to be fairly constant, rendering it unnecessary to assume that it undergoes changes unknown in other organs."

COMMENT

In studying patients with thyroid diseases one is at times unable to place the case in one of the groups given for the classification of goiter, such as adolescent, adenomatous or exophthalmic goiter, and we frequently see cases change from one type to another while under observation. From this histological study it would also seem that a diagnosis made purely on the histological picture without taking into consideration the clinical history and

[1] Hertzler, A. E., Diseases of the Thyroid Gland. Ed. 2, St. Louis, Mosby, 1929, pp. 27, 29, 33, 34, 39.

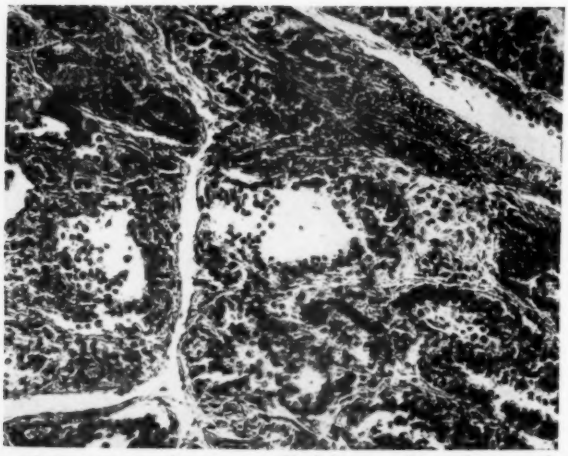

FIG. 23. Male, twenty-five years, died from tuberculous peritonitis.

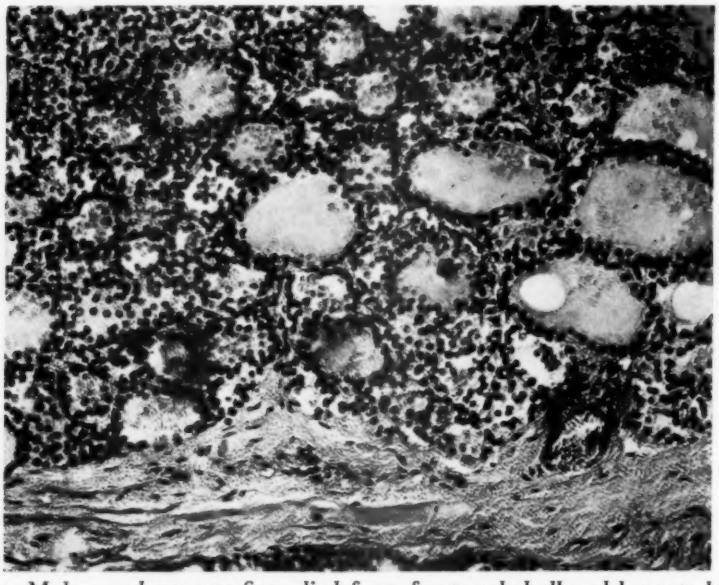

FIG. 24. Male, aged seventy-five, died from fractured skull and lacerated brain.

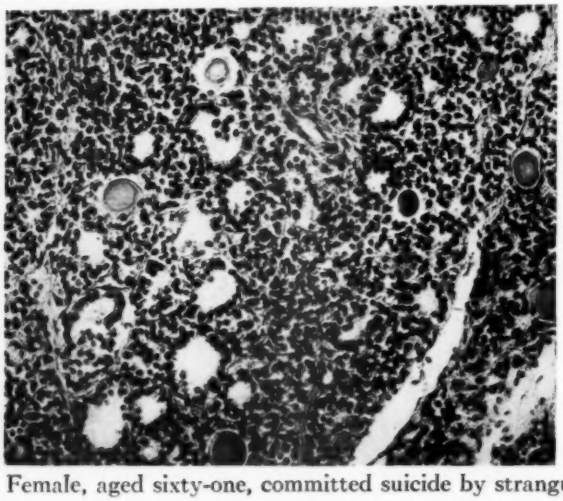

FIG. 25. Female, aged sixty-one, committed suicide by strangulation.

laboratory date is also open to error. It therefore seems that we will be forced to consider the different types of goiter merely as a stage of a continuous disease and not a definite clinical entity, as we have been led to believe in the past.

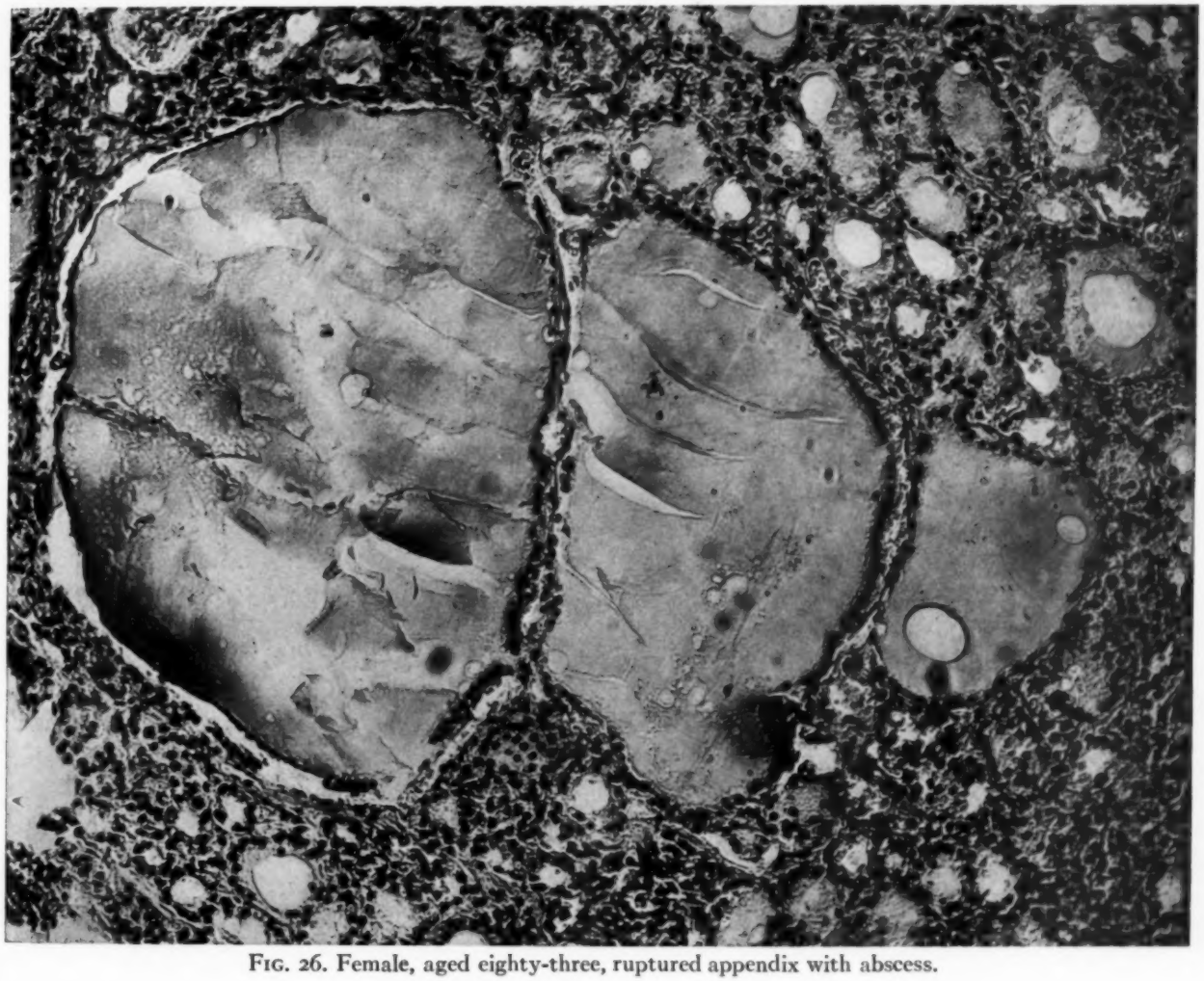

Fig. 26. Female, aged eighty-three, ruptured appendix with abscess.

GASTRIC ACIDITY IN RELATION TO BILIARY TRACT DISEASE

A REPORT OF 100 CASES*

CHARLES W. LUEDERS, M.D., AND L. R. SCHERER, M.D.

PHILADELPHIA, PA.

THE consideration of abnormal figures for gastric acidity as of diagnostic value in diseases of the biliary tract was stimulated by the evidence that accumulated during the separate experience of each of us in the medical and surgical care of patients with upper abdominal complaints. Over the same period came the discovery that save in the achylias, there was a definite tendency to a return to a normal gastric acidity when the symptoms and clinical signs of biliary tract disorders disappeared, following non-surgical bile drainages, operation or both.

The underlying factors joining the derangement of gastric secretion to biliary tract secretion naturally aroused our curiosity and the literature soon showed us that it was a well-known and almost discarded subject. It is only trite to remark here that gastric secretory derangement may be effected through hematogenous toxins; parenchymal changes in the gastric mucosa; nervous, humoral and food factors acting on the secretory glands of the stomach and upon the duodenal mucosa, with alteration of the gastric and intestinal phase of gastric digestion; finally through a derangement of the gastric motor mechanism, linked up with dysfunction of the gall bladder and Oddi's sphincter, to cause an alkaline duodenal regurgitation with a decrease or loss of free hydrochloric acid in gastric contents. Some authors seemed blind to every mechanism save the last one.

Accepting these mechanisms as operative in the type of disorders presented here, there is another factor, that is just beginning to be recognized by the physiologists, that should be brought to the attention of the clinician, namely the glycogen-insulin mechanism, acting through the so-called humoroneural system of Okada and his associates.[1] This system is independent of the humoral (secretin) mechanism, but is correlated with it, and directly affects the secretory function not only of the stomach but of the pancreas and liver as well. Carlson and his co-workers[2] are confirming this fundamental mechanism as affecting gastric and intestinal motility.

Therefore the one point we wish to emphasize is the fact that there is such a direct relation between fluctuations of gastric, pancreatic and biliary secretion, and changes in the glycogen-insulin ratios in the blood; that a true understanding of the humoroneural system gives us a physiological and pharmacological basis for the correlation of disorders of the liver, pancreas and stomach, so that any infection or toxin that injures one, injures the other two; that the portal system is the chief avenue for conveying these toxins, and that the liver is the organ most affected of the three; finally, that the stomach does give an early warning of dysfunction of the liver, an organ whose margin of safety permits of much destruction before serious symptoms are produced. The stomach is just as surely involved in disorders of the gall bladder and connecting bile channels. We wish to summarize Okada's findings and merely outline the latest theories relative to carbohydrate metabolism. The writers are of the opinion that a derangement of the glycogen-insulin mechanism is brought about primarily by disorders of the biliary tract, and that this mechanism acting through the humoroneural system of Okada directly affects

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Read by invitation at the Thirty-third Annual Meeting of the American Gastro-Enterological Association, Atlantic City, May 5 and 6, 1930.

gastric secretion and motility. When proof of the operation of this mechanism can be confirmed by us and others it will more readily explain our findings, namely: a tendency to a return to normal gastric acidity following medical and surgical cure of diseases of the biliary tract.

CARBOHYDRATE METABOLISM

Okada and his associates in their study, in 1929, of the humoral regulation of the gastric, pancreatic and bilary secretions definitely showed that the increased secretion of these juices after the injection of insulin is marked in the presence of hypoglycemia, while it is nearly negative in the absence of hypoglycemia. In other words, hypoglycemia, if it does not alone stimulate the secretion of these juices, does so when insulin is injected. The decrease in the secretion of these juices after the injection of epinephrine goes parallel with hyperglycemia, and is followed by an increase of secretion when a reactive hypoglycemia occurs. Hypoglycemia exerts its stimulating effect at the centrum of the secretory nerve; the stimulus is transmitted to the active tissue cells through the parasympathetic or vagal system. Hyperglycemia inhibits the centrum of the secretory nerve, with impulses transmitted probably through the sympathetic system. This glycogen-insulin regulatory function to the secretory centrum is called by Okada the humeroneural regulation of the digestive juices. In achylia and cancer of the stomach the humoroneural mechanism with the cooperation of the secretin mechanism excites to activity the secretory glands only of the liver and pancreas.

Following a test breakfast at the stage of hyperglycemia, but without injection of insulin or secretin, there was produced either no secretion of acid or a markedly diminished secretion with hypomotility; at the stage of hypoglycemia, the test breakfast gave a normal gastric secretory response with normal motility. During hyperglycemia the subjective sensation was one of fullness; with hypoglycemia, a hunger feeling. In diabetes the same humoroneural regulation of the secretory centrum is in force, being different from that in normal cases only in the threshold for entrance of the impulses.

The humoroneural and the humoral (secretin) mechanism normally cooperate without interference one with the other; an intravenous injection of secretin causing nearly as abundant a secretion of pancreatic juice at the stage of hyperglycemia as at the time of fasting hypoglycemia. When hyperglycemia develops, gastric secretion ceases and the entrance of acid chyme into the duodenum also ceases, so that the secretin mechanism does not have any occasion to function during this period. Finally a reactive hypoglycemia sets in to cause a profuse secretion of gastric juice and an abundant gush of acid chyme into the duodenum, with a distinct increase of pancreatic function, following the full activity of the secretin mechanism.

Histamine, a vigorous excitant of the gastric secretion humorally causes also a profuse secretion of gastric juice at the high point of hyperglycemia, the directly opposite action of insulin. Therefore it follows that the humoroneural regulation does not have any remarkable influence on the humoral (secretin or histamine) mechanism and this in turn proves that the action of histamine does not have anything to do with the humoroneural mechanism.

Carlson, referred to previously, writes:

> One of my associates, Dr. Quigley has found that the gastric hypermotility in insulin hypoglycemia, already known, also occurs in the intestine. He has made the important observation that this hypermotility does not occur if the gastric vagi are severed. In other words this insulin hypermotility of the stomach is due to the hypoglycemia acting on the motor centrum in the medulla.

Richter[3] in his latest work on "The Newer Aspects of Liver Disorders," concludes:

> The study of the abnormal carbohydrate metabolism of the liver has thrown new light

on the parenchymatous disorders of that organ. A knowledge of the bond that unites the vast number of the well known partial functions of the liver is still lacking. There is scarcely another organ in which regenerative and degenertive processes take place in such close proximity. Clinically the liver is especially important for supplying the organ with carbohydrates, lack of which injures not only the organism but the liver itself, suffering an autolytic breakdown. The glycogen constitutes thus the protection against the complete breakdown of the liver activity. It increases the capacity and vitality of the liver cell. In infections the attack on the glycogen supply is an early symptom. The liver with even a slightly damaged parenchyma has not the glycogen supply of the healthy liver. There is therefore an absolutely certain causal connection between liver injury and glycogen impoverishment. The cell that is robbed of its glycogen is disturbed in its functioning. Associated with glycogen impoverishment the tolerance for galactose is reduced; the tolerance rises with the increase of the glycogen supply of the liver. Impairment and improvement of the liver function are thus closely connected with the synthesis and decomposition of glycogen. The synthesis of glycogen and its fixation in the liver must be brought about through the administration of insulin plus the ingestion of glucose. Viewed pathogenically there is a straight line leading from the simple parenchymatous icterus to the grave breakdown of the liver; it is only a matter of gradual difference.

In the latest investigations of Depisch and Hasenöhrl,[4] the authors arrive at these conclusions:

The assimilatory insulin system with its nervous regulation stands in the center of the carbohydrate metabolism. It promotes the absorption of sugar both in the liver and in the tissues. In the liver, this system is counteracted by the sympathetic system and the secretion of the suprarenals, of the posterior lobe of the hypophysis and of the thyroid (liver counterregulation). In the tissues the effect of the insulin is counteracted by the suprarenals and the thyroid (tissue counterregulation). Independent of this hormonal regulation there appears to be also a direct influence of the nervous system on the sugar metabolism in the liver and in the tissues, both promoting and checking it.

If the work of Simpson and Macleod,[5] and of Choi[6] can be accepted, the liver glycogen is the only source of the blood sugar, since muscle glycogen is converted after mobilization into lactic acid and the latter must then be synthesized into liver glycogen before it can supply the blood with sugar.

Forsgren[7] has recently published an interesting observation on glycogen storage in the liver. While studying the relationship between the formation of bile and glycogen in the liver of the rabbit, he found that a cycle existed in the normal animal during which the percentage of glycogen and bile varied inversely to each other. Thus the glycogen was low when the bile was greatest in amount, and vice versa. He also found that glycogen is first deposited around the central vein of the lobule and remains there longest. If a condition exists in the jaundiced animal or patient similar to that found by him in the normal animal, one can see why obstruction of the duct leads to a decreasing glycogen content of the liver. Even without this explanation it is only necessary to examine microscopically sections of the liver from patients suffering from obstruction of the common duct to realize that such a liver is not capable of functioning normally as a glycogen storehouse.

Mills[8] in 1927 showed that vitamine B possesses the power of stimulating the utilization of glucose in the body with certain plant extracts by mouth, and suggests that vitamine B affords the injured pancreas an opportunity of functional recovery. It has been known for some time that pigeons on a vitamine B-free diet have a hyperglycemia and an absence of liver glycogen. His extract does not produce hypoglycemia like yeast extract, is without effect on normal fasting blood sugar, but reduces the hyperglycemia of human diabetes. It greatly increases glycogen storage in the liver, but probably not

directly as does insulin or as Collip's "glucokinin," a plant insulin, but as secondary to its pancreatic effect. Its action seems a direct one on the pancreas, as a metabolic stimulant or as a source of supply of an insulin precursor.

Riddle[9] found the blood sugar relatively high in patients with pernicious anemia (achylia); with a decrease in blood sugar during early remission, as low as 61 mg. and associated with an increase in appetite, caloric intake and body weight. The hypoglycemia appears to be related to a metabolic adjustment of the liver to normal glycogen storage.

The glycogen-insulin mechanism is shown by Okada[10] to be vital in the physiologic process of oxidation, as an incessant oxidation of sugar is unconditionally necessary to maintain the living process. The regulatory influence of this active sugar on the function of the digestive tissues is similar to that of oxygen on the function of the respiratory organs. A deficiency either of oxygen or sugar stimulates the parasympathetic or vagal centrum; oxygen lack producing forced respiration, hypoglycemia digestive hypersecretion and hypermotility (hunger). He has demonstrated that amino-acids and fats stimulate the parasympathetic nervous system: the former, the centrum that controls the gastric secretion, and the latter mainly the centrum that controls the pancreatic and biliary secretions. Such substances might be called the "humoroneural excitants of the secretions of the digestive juices."

Table I

Analysis of 100 cases of biliary tract diseases

Chronic cholecystitis	62
Acute cholecystitis	6
Atony of the biliary tract	5
Cholelithiasis	23
Jaundice	4
	100

Table II

Acidity in chronic cholecystitis

	Cases	Per Cent
Hyperchlorhydria	12	20
Euchlorhydria	6	9
Hypochlorhydria	44	71

Table III

Acidity in cholelithiasis

	Cases	Per Cent
Hyperchlorhydria	17	74
Euchlorhydria	4	17.4
Hypochlorhydria	2	8.6

Table IV

Acidity in atony of biliary tract

	Cases	Per Cent
Hyperchlorhydria	5	100

Acidity in Jaundice, Acute, Toxic

Hyperchlorhydria	4	100

Dextrose on the contrary is "the humoroneural inhibitant."

The 100 cases here reported were especially selected to refute the contention of some writers, namely, that duodenal regurgitation is the chief cause of hypochlorhydria, or even achlorhydria, in diseases of the biliary tract. If a bile-tinged color of the gastric contents is evidence of duodenal regurgitation, not one of the cases with hypoacidity showed even a trace of visible bile except in an occasional isolated fraction. On the contrary bile appeared, in our series, rather in the cases with hyperchlorhydria. Also recognizing the direct relationship of the age incidence and a lowered gastric acidity, we were struck by the number of the older patients who had normal to hyperacid figures.

The chief points of interest in the tables, printed here, seem to be the incidence of hypochlorhydria in 71 per cent of the cases of chronic cholecystitis; and the incidence of hyperchlorhydria in 74 per cent of the cases of cholelithiasis. These figures confirm the results of the majority of other writers in this field of investigation.

Conclusions

1. Gastric hyperacidity is associated with acute disease of the biliary tract and with uncomplicated cholelithiasis whether of short or long duration. Gastric hypoacidity and achlorhydria are associated with chronic disease of the biliary tract.

2. Stress is laid on a newly described humoroneural regulation of gastric, pancreatic and biliary secretion. It is bound to receive the recognition it deserves as a

TABLE V

CHANGES IN GASTRIC ACIDITY FOLLOWING TREATMENT FOR GALL-BLADDER DISEASE

No.	Diagnosis	Therapy	Acidity and Curve						Result
			Before			After			
				T. F.			T. F.		
1	Cholelithiasis	Cholecystectomy	11-1-26	114-62	S.	9-8-30	40-20	N.	Cured
2	Cholelithiasis	Cholecystectomy	1-9-27	93-83	C.	4-11-30	42-26	N.	Cured
3	Cholelithasis	Cholecystectomy	3-12-26	109-57	C.	4-8-30	50-30	N.	Cured
4	Cholelithiasis	Cholecystectomy	3-3-26	33-16	L.	4-15-30	45-30	N.	Cured
5	Cholelithiasis	Cholecystectomy	2-1-30	28-14	L.	9-14-30	52-27	N.	Improved
6	Cholelithiasis	Biliary drainage	2-21-30	50-30	S.	9-5-30	64-36	N.	Improved
7	Acute cholecystitis	Biliary drainage	2-10-29	71-50	C.	4-2-30	60-39	N.	Improved
8	Acute cholecystitis	Biliary drainage	1929	98-67	C.	4-2-30	67-50	N.	Improved
9	Acute cholecystitis	Biliary drainage	3-21-28	70-56	S.	10-29-29	56-31	N.	Improved
10	Acute cholecystitis	Biliary drainage	10-13-28	71-62	S.	9-17-30	52-30	N.	Improved
11	Acute cholecystitis	Biliary drainage	8-22-29	120-80	C.	5-2-30	95-70	N.	Improved
12	Acute cholecystitis	Biliary drainage	10-29-29	56-24	C.	7-21-30	46-22	N.	Cured?
13	Acute cholecystitis	Biliary drainage	5-25-29	98-77	C.	4-14-30	60-39	C.	Improved
14	Chronic cholecystitis	Biliary drainage	9-13-28	36-13	S.	6-3-30	58-35	N.	Improved
15	Chronic cholecystitis	Biliary drainage	6-23-28	89-81	S.	5-5-30	58-45	N.	Improved
16	Chronic cholecystitis	Biliary drainage	5-23-29	39-16	S.	6-11-30	56-23	N.	Improved
17	Chronic cholecystitis	Biliary drainage	6-21-28	30-10	L.	8-22-29	70-40	N.	Cured?
18	Chronic cholecystitis	Biliary drainage	12-21-29	30-14	L.	2-28-30	50-29	N.	Cured?
19	Chronic cholecystitis	Biliary drainage	9-15-29	13-0	L.	4-2-30	57-34	S.	Cured?
20	Atony of gall bladder	Biliary diagnosis	12-22-28	78-32	S.	4-15-30	64-35	S.	Improved
21	Gallstone. Gardiasis	Cholecystectomy	11-22-29	46-24	S.	9-29-30	40-16	N.	Not improved

Note: S signifies sustained curve; C is for continuous; L for low curve; N for normal. T signifies total acidity; F free hydrochloric acid.

valuable acquisition to our knowledge of the humoral regulation of digestive tract secretion and motility.

3. This mechanism, bound up with the glycogen-insulin function of the liver and pancreas, is deranged especially through hematogenous infections and toxemias carried by the portal blood, and disseminated, by way of the connecting lymphatic system, among the liver, gall bladder, pancreas and stomach. The glycogen-insulin function is the first to be affected by infection and intoxication states.

4. The structural and functional disturbance of the entire hepatoenteric system together with a toxic derangement of the splanchnic nerves supplying it, form a syndrome that makes up the broad but probably truer conception of gall-bladder disease.

5. There is a tendency to a return to normal gastric secretion with the disappearance of symptoms of biliary tract disease, following non-surgical drainage, operation, or both. The return to normal gastric secretion was longest delayed in the postoperative patients.

6. The finding of persistent hydrochloric acid deficiency should not be interpreted as an isolated functional or disease entity, but should point first and rather with suspicion to some possible pathology in the biliary tract.

Note: Full acknowledgment is here made of the splendid assistance given the authors by Miss S. A. Lehmann, R. N., in the fractional studies and bile drainages; and by Miss M. E. Watson, laboratory technician, in the analysis and microscopic studies of the gastric and bile samples. Much of this work was assumed by them in addition to their heavy routine duties.

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DISCUSSION

Dr. Ivy: I do not like particularly to criticize anyone, or his work destructively, but in this case, I think the essayist has gone beyond the facts, so far as the explanation is concerned. When one uses the observations of Okada and others to explain achylia, I think that is going beyond the facts. Perhaps these observations do have some bearing on the problem of achlorhydria and hyperchlorhydria, but certainly there are less hypothetical explanations for these conditions. There is a condition which is generally recognized and observed, which causes considerable trouble so far as gastric acidity and symptoms are concerned and that is pylorospasm or reflex gastric disturbances. We know that a diseased condition of the alimentary tract may produce reflex gastric disturbances. We know that gastric retention increases the gastric phase of gastric secretion, and that disturbances of intestinal digestion affect gastric secretion. Is this not a more simple explanation of the changes in gastric secretion in gall-bladder disease than a hormone imbalance hypothesis? In order to know the effect of a diseased condition on gastric secretion, we must make observations before and after the onset of the disease. This is frequently impossible in man. In animals it is possible. We have found by studying gastric secretion before and after cholecystectomy that if there is any change it is slightly increased. We accounted for this by the more or less continuous elimination of bile into the intestine which favorably affected intestinal digestion.

Now, Okada reports that the injection of insulin causes a change in gastric secretion. But one cannot say whether he observed the effect of insulin or some impurity in it, since insulin is about 90 per cent impure and for all we know, his insulin may have had some histamine in it. We have injected insulin into our dogs and failed to observe any effect on their gastric secretion. They secreted gastric juice while manifesting hypoglycemic convulsions. So one must be careful in making hypotheses on the basis of results obtained by injecting impure solutions of hormones in unphysiological amounts.

Dr. Lueders (*closing*): The criticism that Dr. Ivy has directed against Okada and his associates should be directed toward me. The reason for my making such enthusiastic statements was because I thought that this mechanism is probably one way in which we may get to understand the relationship between the stomach and the gall bladder, as well as the liver and the biliary tract. Okada made no such claim for his findings.

In regard to cholelithiasis and the return of gastric secretion to normal following cholecystectomy, I take it that Dr. Ivy did not wait two or three years in his studies, to note the acid figures over that period. If he had done that, he might have found his gall-bladder cases had returned to normal acid figures.

In regard to the purity of insulin used, Okada proved very conclusively that his insulin had no effect, while his histamine had a very pronounced effect, on gastric acidity in the presence of hyperglycemia, and that only in cases of hypoglycemia does insulin act to produce hyperchlorhydria.

GASTRIC SYPHILIS

DATA ACCUMULATED FROM 89 CASES*

PAUL A. O'LEARY, M.D.

ROCHESTER, MINN.

OPINIONS in the literature concerning gastric syphilis are controversial. There are two schools of thought. One of them is composed of those who insist that the recognition of the Spirochaeta pallida in the tissue excised from a gastric lesion is necessary in order to make a diagnosis of gastric syphilis. In the second school it is believed that a similar diagnosis is justifiable in the case of syphilis in which a demonstrable gastric lesion is materially altered by antisyphilitic treatment, when the alteration is accompanied by relief of the gastric symptoms. The discussion is between the microscopist and the empiricist.

Gastric syphilis may be more common than the literature indicates, but less than 0.3 per cent of the syphilitic patients seen in the Mayo Clinic have had gastric syphilis. Andresen noted 4 cases in 202 syphilitic patients, and Meyer noted 5 cases in 1800 roentgenographic examinations of the stomach. Hartwell called attention to the fact that the character of the subjective complaints of patients with gastric syphilis is bizarre. Eusterman reported on the clinical manifestations of a portion of the cases included in this study and emphasized the following facts: The average age incidence was thirty-five years, and the average duration of the complaint was two years; achylia was noted in 85 per cent of the patients, and there was infrequent occurrence of gastric retention and palpable mass, although roentgenologic evidence simulated most closely the appearance in scirrhous carcinoma. The historical data, in many cases, revealed gradual but steady decrease in the capacity of the stomach, in spite of which good appetite often was maintained. Vomiting usually gave immediate relief from the distress that appeared after eating. In commenting on the diagnosis of gastric syphilis, Stokes gave the gastroenterologist a 25 per cent advantage over the roentgenologist in arriving at a definite diagnosis. In practice, the advantage of the gastroenterologist, I believe, is even greater, because the concomitant observations are so essential to a diagnosis.

This report is based on a study of 151 cases in which demonstrable gastric lesions were found, and in which, in addition, the patients had syphilis or were suspected of having syphilis when they were referred to the Section on Dermatology and Syphilology. I have excluded cases in which there were gastric complaints associated with acute syphilis, cases of syphilitic patients with duodenal ulcer, and cases in which the evidence for gastric carcinoma was indisputable, even though clinical syphilis also was demonstrable. Before a definite diagnosis was made, each of these 151 cases was subjected to a group of criteria which included the available diagnostic procedures utilizable in the recognition of gastric syphilis, in addition to periods of observation of at least two years. In fact, the periods of observation ranged from two to nine years. As a result of these requirements, it was found that 36 of these patients had syphilis and gastric carcinoma, 17 had syphilis and simple gastric ulcer, 9 could not be traced, and in 89 a diagnosis of gastric syphilis eventually was made.

The following criteria were demanded in making the diagnosis of syphilis of the stomach: (1) a therapeutic test for gastric syphilis, consisting of observation of the effect of arsphenamine and mercury, or bismuth, was interpreted as successful only after a period of observation of two

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years; my conception of what constitutes a successful therapeutic test will be elaborated subsequently; (2) exclusion of carcinoma and simple ulcer by histopathologic study at operation or at necropsy, or recognition of the histopathologic evidence of syphilis some time after operation, in tissue excised at operation; (3) roentgenologic demonstration of a gastric lesion which had the characteristics that have been frequently described as those of gastric syphilis; (4) clinical evidence of gastric syphilis and the interpretation of the concomitant finding. Moreover, the fact was kept in mind that the recognition of clinical evidence of syphilis is less significant in the diagnosis of gastric syphilis than is the presence of concomitant data in favor of gastric carcinoma or gastric ulcer. I have placed these criteria in the order of their practical diagnostic significance, and although I believe that each one is sufficiently important to warrant individual comment and elucidation, the diagnosis was most often the result of correlation of the combined procedures.

THERAPEUTIC TEST

The estimation of the response to antisyphilitic treatment, in conjunction with a prolonged period of observation, offers the most practical method of arriving at a diagnosis of gastric syphilis. I fully realize that such a statement is debatable, but I trust the subsequent evidence I offer will support this contention. Emphasis concerning some of the essential requirements of the therapeutic test is worthy of attention.

The differential diagnosis between gastric carcinoma and gastric syphilis may be difficult. It is my practice to give the differential therapeutic test while the patient is in the hospital, under close observation, where the intake of food can be measured and the same type of diet can be maintained throughout the test. When possible, the patient is given a "general mixed" diet, and if the gastric capacity is markedly reduced, the daily ration is divided into from four to six meals instead of the customary three. A daily record of weight is maintained, and frequent estimations of the degree of anemia and its variations are made. Medication, other than antisyphilitic remedies, is discontinued. A syphilitic lesion of the stomach is one of the forms of visceral syphilis in which a Herxheimer reaction (increase in the size of a gumma following an initial injection of arsphenamine) is not encountered that is severe enough to contraindicate the liberal use of arsphenamine early in the course of treatment. Accordingly, arsphenamine in doses of from 0.2 to 0.5 gm. is given weekly, coincidentally with inunctions of mercury or daily intramuscular injections of the succinimide of mercury.

The most difficult aspect of the therapeutic test is the determination of just how long the test should be continued. The type of the gastric lesion, as revealed by the roentgenogram, its situation, the duration of the lesion, and the general condition of the patient, are factors which influence such a decision. Morphologically, there are 7 types of gastric syphilis, varying from the simple gumma to diffuse fibrotic involvement of a greater portion of the stomach. In the type with single or multiple gummas, irrespective of their situation in the stomach, and irrespective of a comparatively short history, favorable therapeutic effects are usually manifested in two weeks, and occasionally earlier. However, the hour-glass type or fibrotic type of lesion may show slight, if any, clinical improvement, even following prolonged treatment. It is unwise to attach too much significance to the relief of gastric symptoms early in the course of the therapeutic test. I have observed patients with gastric carcinoma, simple gastric ulcer, and linitis plastica display great enthusiasm following the first or second injection of arsphenamine, due perhaps to psychic effects or to the non-specific effect of the arsenic. A persistent and steady gain in weight, accompanied by a decrease of the

anemia, and the ability to eat larger amounts of food, with less discomfort, are of more significance than changes in the patient's subjective complaint. When these phenomena occur coincidentally and in a marked degree, the result of the therapeutic test is startling. If gastric carcinoma is present in a patient with latent syphilis, the temporary flare of improvement in the subjective complaint is usually followed by slow loss of weight and strength, with failure to show improvement in the other manifestations previously mentioned. Although 5 of the patients in this study gave a history of hemoptysis, and blood was demonstrated in the stools of 4, I have never observed a gastric hemorrhage in a patient with gastric syphilis undergoing a therapeutic test. Such accidents have occurred, however, not infrequently in cases of gastric carcinoma under therapeutic test. In those patients who have responded satisfactorily to the first course of 6 injections of arsphenamine, and of a corresponding amount of mercury, at least 3 more courses of similar amounts are recommended at intervals of four months, and in the intervals, mercury or bismuth is administered.

In addition to the use of antisyphilitic remedies, a period of observation, frequently a prolonged one, is essential to the therapeutic test. The wisdom of maintaining the period of observation is obvious in those cases in which the patients derive a non-specific effect from the arsphenamines, and particularly in the low-grade type of gastric carcinoma in which the progress of the disease is slow. The cases in which it is most difficult to appraise the therapeutic test are those with diffuse or extensive gastric involvement of the fibrotic type. The phenomenon of spontaneous involution, of the type of gastric syphilis with fibrosis, is of rare occurrence, and is particularly hard to demonstrate clinically early in the course of the disease. I do not believe a diagnosis of "leather bottle stomach," if the term infers syphilitic etiology, is justified without histopathologic study of excised tissue to exclude the presence of carcinoma.

The criteria which I have used for a positive therapeutic test consist of rapid and persistent symptomatic relief of the gastric symptoms, coincident with gain in weight and strength, decrease of anemia, and increasing appearance of well-being, augmented by persistence of improvement for at least two years. In about half of the cases, anatomic change in the gastric deformity may be anticipated, while changes in the gastric chemical determinations, although occasionally present, are less significant. The degree of symptomatic relief, and the amount of anatomic change, are dependent on the type of the gastric lesion. An appraisal of the results of treatment, after periods of observation ranging from two to nine years, shows the following: of 81 patients, 37 per cent are clinically "cured"; the condition of 27 per cent is improved and of 29 per cent is unchanged; 7 per cent are dead. The present status of the 8 other patients of the 89 who had gastric syphilis is unknown. By clinical cure I mean the disappearance of gastric distress and the ability to eat the average wholesome diet without symptoms. This interpretation was based solely on the patient's statement and was made irrespective of the roentgenologic observations at that time. The group in which the condition was reported as being improved, included patients who still had subjective complaints, but of a less marked degree. They were, in the main, patients with extensive gastric involvement when treatment was started, and with complaints of long duration. Those whose condition was not improved were contending with a contracted stomach, the result of interstitial fibrosis, and were greatly embarrassed by the small capacity of their stomachs. In this type of patient neither continued antisyphilitic treatment nor plastic gastric surgery offers relief.

The problems in the treatment of gastric syphilis resemble those in the treatment of other forms of visceral and neurologic

syphilis. The disease is characterized by its destructive ability, its occasional spontaneous involution, and the rapid response to treatment of the active manifestations. Unfortunately, the resulting scarring, whether in the skin, aorta, or stomach, is productive of subjective or objective signs, or both. Hence, the necessity for early recognition of gastric syphilis and for institution of intensive antisyphilitic treatment is obvious.

HISTOPATHOLOGIC AND GROSS PATHOLOGIC STUDIES

There were 36 patients in this series who had gastric carcinoma and syphilis in one form or another. In 16 cases, the diagnosis of gastric carcinoma was made histopathologically at the time of operation, following an unsuccessful therapeutic test. In the remaining 20 cases, the evidence favored a diagnosis of gastric carcinoma at the outset; but because the lesion was of the inoperable type, and because the accompanying signs of visceral carcinoma were less pronounced than those usually noted, the patient was given a short therapeutic test for syphilis before being dismissed as incurable. There were 17 patients with simple gastric ulcer and syphilis, and practically all of them were referred to my care with the combined diagnosis. Antisyphilitic treatment was given while the patient was undergoing medical treatment for the ulcer, or was in preparation for operation. The incidence of correct diagnosis emphasized the fact that the obstacles to differential diagnosis between gastric ulcer and gastric syphilis are less frequently encountered and are less difficult than those encountered in making a differential diagnosis between gastric syphilis and gastric carcinoma.

There were 19 patients in the group with gastric syphilides, from the stomach of each of whom a section was removed and examined histopathologically. Spirochaeta pallida was not found in any case. In 9 the pathologist reported the tissue as syphilitic, and in 4 as "probably syphilitic"; in 5, the report was of inflammatory tissue. The Section on Pathologic Anatomy, in its necropsy service, has found 3 cases of gastric syphilis, in all of which the diagnosis was made before death, and in which death was due to other diseases.

The literature indicates that syphilis of the stomach is manifested in 7 different varieties: (1) multiple ulcers (gummas), (2) single ulcers, (3) diffuse gummatous infiltration, (4) nodular-ulcerative lesions, (5) chronic interstitial fibrosis, (6) nodule, and (7) linitis plastica (Singer-Meyer). The macroscopic appearance of the stomach in gastric syphilis is not sufficiently well known in this country to permit of diagnosis in the operating room, unaided, in any but a small percentage of cases. The comparative rarity of the disease, its varied manifestations, and its resemblance to carcinoma make the diagnosis difficult. Luria reported that in Russia the diagnosis usually is made at the time of operation as a result of the large experience Russian surgeons have had with visceral syphilis. The presence, for example, of visceral syphilis and in particular of hepatic syphilis, may lead to the suspicion that gastric syphilis is present. However, the report of the pathologist, excluding carcinoma, is the basis for the tentative diagnosis in the majority of cases at the time of operation.

Hartwell reviewed the literature up to 1925; he found only 25 cases in which he felt that the diagnosis of gastric syphilis had been substantiated by the pathologic data. However, he was unable to determine what constitutes the classic histopathologic picture of gastric syphilis because of the varied descriptions that have been given. That it is necessary to demonstrate the Spirochaeta pallida in the excised tissue in order to make an absolute diagnosis is prominent among the criteria demanded by some authors. Only two investigators, Warthin and McNee, have reported successful demonstration of the organism. Singer and Dyas doubted that the organisms found by McNee were Spirochaeta pallida, and

expressed the belief that they were Vincent's spirilla. Hartwell, however, accepted McNee's observations as authentic. Warthin reported that he has demonstrated the Spirochaeta pallida in 8 cases of gastric syphilis, in practically all of which operation was done because of a diagnosis of peptic ulcer. The incidence of the demonstration of the Spirochaeta pallida in the gastric ulcer of the gummatous type no doubt will be higher in the hands of pathologists who become expert in its identification. As Hartwell noted, the histopathologic description of gastric syphilis has not as yet become sufficiently well recognized by general pathologists to enable unequivocal diagnosis to be made. In the chronic interstitial fibrotic type of gastric syphilis, in which the finding of the Spirochaeta pallida has not as yet been reported, and in which the typical microscopic picture has not, as yet, been described, the diagnosis is made primarily by exclusion on the basis both of clinical and histopathologic data.

Singer and Dyas also called attention to the fact that it is difficult to describe a classic histopathologic picture of gastric syphilis because of the fact that the disease is not only seen in a variety of forms, but also because it is a transitory disease. Singer emphasized the latter point by endeavoring to show that certain cases of linitis plastica are the end-stages of diffuse interstitial syphilitic fibrosis. There was 1 case in my series that substantiated Singer's suggestion, but the study of 38 cases of linitis plastica in the Mayo Clinic, reported by Lyons, showed that linitis plastica is a manifestation of small-cell carcinoma.

Gastric syphilis is analogous histopathologically to hepatic syphilis. The end-stage of hepatic syphilis, namely, syphilitic cirrhosis of the liver, cannot be recognized as a syphilitic process, either macroscopically or microscopically. However, during the active phase of gummatous hepatitis, the histopathologic picture may be definite. On the other hand, syphilitic hepatic cirrhosis is difficult to diagnose under the microscope. The same may be said of gastric syphilis. Gastric gummas are not only readily recognizable histopathologically but they offer the likelihood of demonstrating the Spirochaeta pallida. The diffuse interstitial fibrotic type of gastric syphilis does not present a picture characteristic of syphilis or the possibility of demonstrating the organism. In other words, various pathologic pictures are to be found in gastric syphilis, some of which are specific, whereas others are non-specific. Accordingly, it is impossible to demand a histopathologic diagnosis in all cases. Hence, the need for recording in the literature reports of the various pathologic pictures of gastric syphilis, as encountered from time to time, is obvious. Likewise, the criteria for diagnosis should be modified so as to demand a histopathologic diagnosis in the type of case in which it is feasible.

ROENTGENOLOGIC FEATURES

It has been my experience that the roentgenologist, at times, may make the diagnosis of gastric syphilis unequivocally. However, he more frequently raises the question of the existence of possibility of syphilis. Gastric syphilis was more frequently misdiagnosed as gastric carcinoma than as any other lesion in this series. The presence of the personal equation was obvious in this study, indicating that the suspicion of syphilis was entertained by different roentgenologists in varying degrees. This factor is always of paramount importance in interpreting the results of any clinical examination for syphilis. It does not seem necessary to give the characteristic roentgenologic morphologic changes in gastric syphilis, for they have been ably enumerated by Carman and more recently by Moore and Aurelius. However, for emphasis, mention may be made of the need of recognizing the concomitant features, such as disproportionate loss of weight, absence of cachexia, slight anemia, persistent appetite, the ability to obtain relief from vomiting, and a long history of gastric complaint.

In the 89 cases, the roentgenologist diagnosed 44 as gastric syphilis. Thirty-two, which were diagnosed as carcinoma, were later proved by my requirements to be cases of gastric syphilis. The 89 cases, it will be remembered, constituted a group in which the diagnosis of gastric syphilis finally was established. There were 62 others, making 151 in all, in which demonstrable gastric lesions and syphilis were present but the presence of gastric syphilis was not established. Of these 62, 6 were diagnosed as syphilitic ulcer of the stomach, only to have the diagnosis changed to carcinoma later. These diagnoses were made by the roentgenologists solely from the roentgenologic data, and indicate an incidence of roentgenologic diagnosis that is higher than the average. In 21 of the 47 cases in which roentgenologic studies were done, following one or two courses of treatment, varying degrees of improvement were seen in the changes in the gastric deformity. There were 16 of the 47 cases in which noteworthy changes were not observed by roentgenologic methods, but in which there was symptomatic "cure." McGlannan has also called attention to cases in which the features were like those of these 16.

CLINICAL EVIDENCE OF SYPHILIS

The clinical evidence for syphilis was sought in the Section on Dermatology and Syphilology. Little, if any, attention was paid to a history of chancre or to the other manifestations of acute syphilis, and neither was one report of Wassermann reaction accepted as final. In all the cases in which clinical evidence of syphilis was not recognized, a provocative Wassermann procedure was carried out or a Wassermann reaction was done each day for five to seven days. In the last four years, the Kolmer and Kahn tests have been done simultaneously in all dubious cases; an examination of spinal fluid was done in all cases except in patients aged more than fifty-five years and in a few who were too acutely ill to be subjected to the procedure.

Of the patients with gastric syphilis, 27 per cent had other clinical signs of syphilis. In 9 patients (11 per cent) there were positive findings in the spinal fluid. Seventy-three per cent had repeatedly positive Wassermann reactions of the blood, as the only evidence of syphilis other than the roentgenologic features. There were 6 patients who had negative Wassermann reactions, and who were proved to have gastric syphilis. The clinical signs of syphilis, in 27 per cent of the cases, may be compared with the 16 per cent of the patients who had gastric carcinoma and syphilis, and also clinical signs of syphilis. The demonstration of clinical evidence of syphilis in a patient with an indeterminate type of gastric lesion does not warrant a diagnosis of gastric syphilis, because the incidence of positive clinical signs of syphilis was almost as high in the patients with gastric carcinoma as in those with gastric syphilis.

SUMMARY

Eighty-nine of a group of 151 patients with gastric lesions and syphilis were found to have gastric syphilis. These were selected from among approximately 25,000 patients with syphilis. The diagnosis was based on the combined results of prolonged therapeutic tests, histopathologic studies, morphologic changes in the roentgenologic characteristics, and restoration of gastric function. The demonstration of the existence of other evidence of clinical syphilis is not pertinent to the diagnosis of gastric syphilis. Of the 89 patients with gastric syphilis, 73 per cent had positive Wassermann reaction of the blood as the only other evidence of syphilis, and 6 per cent had negative serologic reactions. The incidence of clinical signs of syphilis was almost as high in those cases with gastric carcinoma (16 per cent) as it was in those with syphilides of the stomach (27 per cent). Recognition of the Spirochaeta pallida in excised gastric tissue as the conclusive means of diagnosis is a diagnostic requirement demanded by the scientific

purist. I would prefer to see among the diagnostic criteria for gastric syphilis one demanding a histopathologic study to eliminate carcinoma. Although the Spirochaeta pallida may be demonstrated in the gummatous type of gastric ulcer, in cases of diffuse syphilitic fibrosis the organism has not as yet been recognized. Numerous instances of the bizarre character of both the clinical and microscopic features of gastric syphilis merely confirm the knowledge that syphilis is a protean disease.

The incidence of cure in gastric syphilis is less than the occasional cases with dramatic improvement leads us to believe. In this study, 37 per cent were cured, and the condition of 27 per cent was improved. The result of treatment in the fibrosed syphilitic stomach is unsatisfactory, and plastic gastric operation offers slight help. Linitis plastica is a term that should be reserved for small-cell carcinoma of the stomach, and should not be used in relation to gastric syphilis because of the attendant confusion. Spontaneous involution or antisyphilitic treatment may account for the fibrotic leatherbottle stomach, for which the name of gastric syphilitic fibrosis is suggested. In patients in whom the gastric lesion is reported as operable but of indeterminate type the therapeutic test should be limited when the response is exceptionally slow and an exploratory laparotomy done, rather than subject the patient to a too prolonged test.

As in all forms of syphilis, early diagnosis and early institution of treatment are rewarded by a higher incidence of cure than is obtained otherwise, a fact forcibly emphasized by this study.

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DISCUSSION

Dr. Bockus: About two years ago we analyzed a series of 22 cases in which syphilis was associated with lesions in the upper portion of the intestinal tract, and the two pertinent things which we noticed at that time were, a marked tendency to cardiospasm with some dilatation of the esophagus and duodenal stasis. I would like to know if Dr. O'Leary has not noted in some of his cases this tendency to multiplicity of roentgen defects in gastric syphilis. We had a very unfortunate experience in our cases with an ulcerating type of gastric lesion. Two of them perforated while undergoing treatment in spite of the fact that we were very cautious in the use of neoarsphenamine. I would like to know if Dr. O'Leary has had a similar experience.

Dr. Moore: I take this occasion to report the end-results of a treatment reported on, several years ago. There was at that time a considerable difference of opinion regarding the diagnosis of this condition as syphilis, but we felt sure that it was syphilis, from the clinical behavior, the laboratory findings and the response to the laboratory tests. The patient was treated for syphilis, and died last fall, and we did get a chance to examine the pyloric portion of the alimentary tract, and it showed no signs of an epithelial growth, thus justifying our clinical findings.

Dr. Smithies: I just want to take this

occasion to state that 5 of our 12 patients whom I reported on several years ago, and who had definite, palpable tumor, with symptoms of syphilis, are still living, and, apparently, "going strong." We have to push the medical treatment very strongly, in those cases, giving them sometimes as high as 240 grains of potassium iodide in ½ gal. of water daily and keeping that up as long as we can get them to continue it. It is quite expensive.

Dr. O'Leary, (*closing*): I was particularly interested in Dr. McGlannon's further report of the case he recorded several years ago. The diagnosis of gastric syphilis made by Dr. McGlannon at that time seems conclusively proved by this subsequent observation. I made no mention in my presentation of the changes in the gastric chemistry of patients with gastric syphilis following antisyphilitic treatment, but it is our experience that the majority of cases who have not developed gastric fibrosis show a return to normal. The point brought up in regard to duodenal stasis was well made. I have not seen a case of gastric syphilis with evidence of perforation, although gastric retention has not been an uncommon finding in my cases. The presence of a palpable gastric tumor was noted in 7 of the last 10 cases of gastric syphilis I have seen. When a suspicion of gastric syphilis is aroused the therapeutic test for syphilis is the ideal manner in which to substantiate or disprove the suspicion. The need for surgical intervention and the opportunity for histologic diagnosis are dependent on the success or failure of the therapeutic test.

THE NEED FOR "STANDARDS" IN INVESTIGATIVE AND THERAPEUTIC WORK IN GASTROENTEROLOGY*

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IT has always appeared to me that on such occasions as this, the opening remarks of your President should be more suggestive than didactic. Annually, opening remarks might serve to emphasize steps in the progress of our specialty, or to indicate along what lines profitable endeavors might be directed with respect to diagnosis and treatment.

In accordance with this interpretation of the functions of a presidential address, it seems advisable to direct your attention to the need for what one might term "standards" in research, routine clinical diagnostic methods and of appraising the results of treatment.

I hesitated a long time before choosing the word "standards." I am well aware that the application of the word "standard" to an investigative method or to a form of clinical management might imply a certain lack of individual cerebration or of effort directed to meeting the requirements of the particular patient. Furthermore, emphasis upon "standards" carries the disagreeable suggestion of mechanical aids and, perhaps, an attempt coldly to fit a subject to a system. However, it seems to me that in the field of our ordinary everyday effort, the necessity for "standards" is quite as essential as is the establishment by governmental bureaus of standard procedures by which time, space, length, breadth, color, weight, etc., can be described. It is only by the accumulation of material conveniently arranged and indexed after a similar fashion, that, we can correctly appraise results and evaluate progress in our special field. Just as among governments, there is an international agreement as to what constitutes a liter or a quart, a meter or a yard, a volt and ohm, so does it seem to be necessary that among gastroenterologists, standards of procedure, whether investigative or clinical, be established that clinicians and laboratory workers may speak the same language about similar or dissimilar things.

Let me take one phase of routine or of research work dealing with the stomach, namely, the determination of gastric secretion in health or in disease. Since the time of the older gastroenterologists, notably Ewald, Boas, and Kussmaul, the most common clinical method for estimating gastric secretion has been by means of a test meal, administered when the stomach presumably was empty, and its effect noted as a digestive stimulus over an arbitrarily set time-period of one hour. Probably millions of such test meals, or variants of them (bread and water, tea and toast, shredded wheat biscuits and water, etc., etc.) have been administered, apparently with little questioning as to their being a suitable load capable of initiating and maintaining gastric work. The meals have been left in the stomach, anywhere from forty-five minutes to an hour following the ingestion of the last morsel, and at the end of the time-period, the stomach has been emptied, usually with the aid of a tube or, in the last few years, by a Rehfuss or similar tube constantly in the stomach, the fractions of the meal being removed at intervals of a few minutes.

The physiologic facts of digestion are that carbohydrate cleavage begins and is carried to a fairly advanced stage in the mouth and in the esophagus; gastric digestion largely is concerned with beginning the digestion of proteins. Yet, in health as well as in disease, clinically, the attempt is made to gauge the digestive capacity of the stomach, an organ having to do with the initiation of peptic digestion,

* Presidential Address, American Gastro-Enterological Association, Annual Meeting, Atlantic City, May 5, 1930.

by a meal which is from 75 to 90 per cent carbohydrate, and whose physical character is such, that its puree-like mass begins to emerge from the normal stomach within a few minutes following its reception.

It is by such feebly stimulating and unphysiologic agent that there has been recorded the capacity of the stomach for peptic digestion in health and in disease. From such records one can say only, that a test meal as the Ewald or its variants, represents nothing more than what response, secretorily, an individual stomach gives at a particular time, when a carbohydrate meal initiates and carries on carbohydrate digestion in the mouth, throat and esophagus, and what response an individual stomach makes at a particular time, when a smooth food mass acts mechanically through a given time-phase upon the gastric mucosa. Doubtless, test meals as the Ewald were first exhibited because it was felt that, in dyspeptic individuals, the ingestion of a small non-irritant food mass would be well borne and not cause pain or vomiting. Possibly, too, such a simple meal was easily withdrawn and when color changes were employed to test acidity and peptic activity, there was little, if any, interference, with their recognition. Such a simple meal likewise facilitated microscopic examination. However, one cannot say, by the widest stretch of the imagination, that meals of the Ewald type are, in individuals or in groups, indices of the secretory or the motor capabilities of the stomach. These meals have become "standard" in the unfavorable sense of the word, namely, they have been given without thought of their physiologic significance. It is true, that if at the hands of many physicians, these meals are administered, one can say that the results are of a certain comparative worth, that is, comparative worth of an indirect nature: namely, they indicate what a carbohydrate meal will do toward the excitation of secretion and movement in an organ equipped for the digestion of non-carbohydrate food. The foundations of our investigative work in gastric indigestion rest largely upon evidence secured by Ewald-like meals in this way. It would be interesting to surmise what racial variations would be presented when gastric secretion was estimated by such carbohydrate meals in races whose food is largely carbohydrate (as Italians, vegetarians, etc.) and those whose food is largely protein and fat (Eskimos, Nordics, savages and the like).

Certainly, it would seem that if clinicians and students are to place any reliance whatever upon the test meal study of gastric function, meals must be employed which call forth not only, primarily, digestive secretion in the stomach itself but the secondary or hormonal effects of properly initiated and maintained gastric digestion upon pancreatic, hepatic and enteric secretion and motility.

But I hear the criticism that I am not entirely fair to the gastroenterologist, because it is said he does employ meals which do give opportunity for the initiation and development of a digestive cycle in response to protein stimulation. In a measure, criticism is just. Such full dinners as that suggested by Riegel are a true index of the digestive capabilities of the stomach, because not only do such meals excite the carbohydrate digestive efforts in the mouth and esophagus and the digestive activity of the pancreas, liver and jejunum, but they furnish adequate bulk for gauging the motor integrity of the stomach. Such a meal is entirely physiologic whether it is removed fractionally at quarter hour intervals, as long as any of it remains in the stomach or whether it is removed en masse at a time arbitrarily set (two to four hours). Particularly is such a meal helpful if it is selected by the patient to suit his likes and dislikes and to conform with his racial or environmental customs. But, here again we are faced with the need of standards because there has nowhere been established a set custom as to whether the meal should be removed fractionally or if removed en masse at what hour after

the completion of its ingestion should it be removed. It is well known that what I choose to call "velocity of digestion" varies greatly in individuals of the same age and sex, in different races, and, in these various meal recipients, at different times, dependent upon many such elements as season, the emotions, fatigue, exercise, etc. Be it admitted that various difficulties can be overcome clinically or in research, and that such a meal represents as nearly as possible the true status at a given time in a given individual of his digestive capabilities toward a particular meal, yet, *it is not upon figures derived from such studies that our ideas, or one might say our standards, have been established.* They should be: the whole question of gastric response to food needs re-doing, on the basis of physiologic principles.

One can search in vain through the literature to find results of studies in these directions. In other words, we lack standard information upon what in *health* the stomach is able to do digestively toward *mixed meals*, when physiologically considered. Not only do we lack such standards for the human family as a whole, but they are lacking with respect to digestive variations in the different decades of life, the sexes, the races, in different seasons and so forth.

Based largely upon the results secured with the Ewald meal, an extensive literature regarding hydrochloric acid and pepsin values associated with disease of the stomach, particularly ulcer, has appeared, most of which is worthless. Upon such evidence, it is commonly assumed that peptic ulcer is accompanied by hyperchlorhydria, and, in fact, very often it is assumed in general practice that hyperchlorhydria *means* ulcer. It is extraordinary how rapidly this attitude toward ulcer has translated such clinical symptoms as heartburn, pyrosis and water-brash into "hyperchlorhydria." These clinical symptoms, known to the laity under the general heading of "sour stomach" and, indeed, considered as such by many physicians, are assumed to mean excess acid secretion, in some vague way initiated by an ulcer. "Sour stomach," technically called heartburn, pyrosis, and water-brash, does not mean excess gastric acidity, but means usually only that gastric acid, as result of increased gastric tonus, appears in the esophagus above the normal regurgitant zone of 1½ in. cephalad to the cardia. Certainly, more effort should be made to bring about realization on the part of both patient and doctor that sour stomach frequently bears no relationship whatever to the quantity or degree of stomach acidity. All of us are familar with how common it is for patients to be treated for years for peptic ulcer largely on the basis of misinterpretation of what sour stomach actually means physiologically. Not only does such a method of management lead to a lot of useless dosing with alkalies but it is responsible for statistical inaccuracies: the literature and hospital records become filled with diagnoses of peptic ulcers which never have existed and at the same time are lacking in the recognition of those extragastric ailments which are responsible for reflex motor, and perhaps secretory, phenomena on the part of the stomach.

Granting, that by a physiologically correct test meal administered to patients under suitable control, it is possible to secure estimates of acid and peptic secretion in the stomach, it is quite evident that before the results obtained can be considered seriously as indicating digestive activity in the presence of ulcer, one must look at the returns from the standpoint of the status of the ulcer itself. Thinking *pathologically*, becomes necessary before it is possible to say anything about what acid values mean as they are returned from stomachs harboring ulcers. Great series of single specimen analyses or of curves plotted fractionally during a digestive phase have accumulated. What do they mean? Nothing but the accidental secretory capabilities of stomachs at the one occasion when the tests were made. What do pathologic variations in the stages of ulcer

contribute? No accurate evidence is available. Yet from these returns, attempts have been made to say that when ulcer exists in a stomach the acidity or the acid curve is thus and so and the motor cycle is this or that. Certainly, the figures and curves are *correct*, but the difficulty lies in comparing them or in establishing standards indicating what acidity is to be expected when ulcer is present, here or there, or is at an active, progressing stage, or silent. This failure to denote certain facts regarding ulcers vitiates the whole theory of the usefulness of test meal studies. They test nothing.

There are two very important facts which must be known relative to the ulcer at hand before any interpretation can be made of what significance acid and peptic values have. First, I would mention the influence of the pathologic state of the ulcer at the time a test meal study is made. It is scarcely to be expected that the test meal returns will be the same or comparable upon ulcers, pathologically, acute and superficial, large and penetrating, deforming and thick with scar, actively or recently bleeding, actually perforated or undergoing malignant degeneration; yet, a careful survey of the literature fails to record acidity and peptic values described as related to pathologic type of ulcer or its position in the wall of the viscera (stomach or duodenum). Is it any wonder that the whole subject of acidity in its relationship to ulcer exhibits only confusion. Hundreds of capable workers have analyzed thousands of test meals and have attempted to have the results of their analyses indicate how acid secretion in ulcer varies from the normal and yet have never attempted to define just what kind of ulcers, pathologically speaking, they were discussing.

A second factor is concerned with not only the acidity an ulcer exhibits, at its various pathologic stages, but how is acidity affected by the position in the viscus the ulcer occupies. While it is known that fully two-thirds of the ulcers of the stomach lie distal to a line drawn from the right margin of the cardia, to the middle of the greater curvature, yet, sufficient ulcers lie proximal to such a line as to prevent any generalization with respect to acid values in test meals even though the pathologic status of the ulcer is recognized. Anatomically and histologically, it is evident that ulcers located in the receiving and acid secreting segments of the stomach wall, must produce different effects upon the digestive curve than when such ulcers are located in the portions of the stomach devoted to the mixing of food, the liberation of pepsin and the discharge of food from the stomach. Certainly, ulcers located near the cardia or in the fundus of the stomach are capable of producing changes from the normal digestive cycle of a type differing from those ulcers lying in the pars media (with or without hour glass or accessory crater) and from those in the antrum or pylorus where the possibility has to be considered of radically disturbing the emptying time of the stomach, either as the result of pronounced local spasm, perforation with fixation of the part, or organic stenosis accompanied by gastric dilatation and food stagnation. Not until test meal reports are tabulated with respect both to the *pathological status* and the anatomic *position* of the ulcer in the viscus and the mechanical alterations due to ulcer growth, repair or breaking down, can test meal studies be of any significance diagnostically, or as indicating degrees of disturbed physiology or as guides for therapy.

One must frankly admit that most of the work which has been done with test meals for the determination of gastric function in the presence of organic gastric lesion (particularly ulcer and probably also cancer) represents wasted effort. It is time that the figures in the literature and numerous tables were consigned to the scrap-basket and that the work were carried forward along intelligent lines: the employment of a suitable physiologic meal, a meal accepted as standard, a procedure

carried out similarly by all observers and in the tabulation of the results where pathology is present, a grouping of the findings according to the pathology present and to the portion of the viscus in which the pathologic lesion lies.

This discussion has been introduced purposely to emphasize what I mean by the necessity for standards, in research or diagnostic, everyday investigation of alimentary tract disease. Instances where other types of work have not been intelligently done and where the indications are that much of it will have to be done anew, are many. Time permits the listing of but a few. Observations with respect to the presence and significance of occult blood in gastric contents or in the stool must be made and interpreted only in the light of the pathologic status of lesions and by careful physical examination for the source of bleeding in the portion of the alimentary tract suspected of being diseased and only when the contents of the alimentary tract have been controlled with regard to the absence of substances producing positive responses (meats, meal soups, iron-containing foods or medicinal remedies). Further, it would be useful for purposes of statistical study, if a like procedure with a given reagent were employed by various workers. There is no question that test solutions made with the pinkish-gray benzidin powder give sharper reactions and are less subject to error from extraneous causes than are test solutions made with aloin, guaiac, phenolphthalein, etc.

Reports of *x-ray examinations* of the rate of progress of food from the mouth to the external anal ring exhibit many discrepancies in method so that not rarely the interpretation of the results obtained by various workers is most difficult. A fundamental fault with all these roentgen progress meals lies in the fact that the medium in which barium or bismuth is suspended, is itself a food, which is capable of being digested. It follows, therefore, that just so soon as the roentgen meal is taken into the mouth, digestion of the medium suspending the opaque substance begins, with the result that, at least from the stomach distalward, there is left a metallic mass, heavy in proportion to its bulk, which mass does not excite the normal interlocking play of secretion and motility, as does a food, as it travels downward. The progress meals of which we now have roentgen films, merely indicate, in individuals or groups of individuals, how a *similar foreign body* is passed through the alimentary tract. It is readily seen how confusion arises in attempting to appraise the meaning of residues in various viscera or parts of viscera; in fact, one need only study the *same patient* by *several* progress series to appreciate the difficulties of correct interpretation. If the *same individual* exhibits such great variation, then it is not to be wondered at that *groups of individuals* exhibit variations which often prevent any sort of intelligent comparison, diagnostically. What effect upon the progress of roentgen meals through the alimentary canal have absences, deficiencies or increases of digestive secretion, or of disturbances in the correlated neuromuscular activity and tonus, has not been determined.

Other fruitful fields for the establishment of methods which can be called truly *standard*, and which will be carried out by groups of men and from which results that are comparable can be studied, are procedures for testing pancreatic function; the function of the liver (both the excretory and block functions); a uniform method for conducting duodenal drainage of the biliary tract with a formula for interpreting results; a standard diet by which intestinal digestion may be estimated, and results compared; the correct evaluation of the significance etiologically and pathologically of the various alimentary tract protozoa; a mutually understood classification of achylia, and the significance of achlorhydria with or without the employment of histamine; the classification of the forms of colitis, particularly with reference to the significance of constitutional faults;

general or localized abnormalities in the neuromuscular balance or tonus; and the grouping of intestinal flora with the object of establishing which are abnormal or pathogenic and those which are transient or non-pathogenic; the proper technique of proctoscopy and a useful classification of what proctoscopic findings indicate actual visceral disease and those which mean transient, insignificant happening.

One who has had thorough and long-time experience in the investigation of alimentary tract function and contents, all too readily recognizes and admits the limitations which are placed upon our securing accurate or dependable information relative to function, not only in the given subject but in groups of individuals. While variations in the human family will always impose limitations to the securing of absolutely accurate and comparable information regarding digestive activity, there is no reason why if dependable and simple tests and procedures are adopted and routinely carried out, helpful information, and information of comparative worth in the individual and in groups of patients, cannot be obtained. Simplification should be the key word: a few reliable, well-planned, practical test-maneuvers can be made to yield facts, helpful in diagnosing anomalies of digestion and comparable in the appraisal of the anomalies incident to groups of patients.

It is our hope that, before long, a committee can be formed which will pass upon what is useful and what are "frills" and that when this has been accomplished, gastrointestinal invalids can be examined with less discomfort, the results of their test-maneuvers will mean something helpful toward the elucidation of their ailments and reports of their studies will be broadly comparable and hence, instructive.

If this paper contributes anything toward hastening that day, your President will feel that he has served our Association vitally.

CLASS TEACHING IN PEPTIC ULCER*

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THIS is the story of an earnest effort to improve the treatment of peptic ulcer in the charity patients in the Gastro-Intestinal Clinic of the Boston City Hospital; an improvement to be brought about by the systematic education of the patients in groups. We believe this method is valuable and important and also practical.

We will give our reasons for the need of this education, tell how we have given it and say something about our results with it in the past year.

This paper does not deal with the general subject of the treatment of ulcer, but tells why we use class work and how we do it.

GENERAL CONSIDERATIONS

The idea of a health class is not new. It has been successfully used in tuberculosis, diabetes and other conditions. The idea of education in ulcer is not new. We all need to give it, but we wish to point out that the poorer, less intelligent, hospital patients need education most and are precisely the ones who may not get it owing to lack of time where large groups of patients have to be dealt with in an hour or two. We have had quite satisfactory results with the medical treatment of ulcer in our private patients and have started a campaign of education to try to bring the results in our City Hospital cases up to the same level.

We wish to emphasize the fact that all these patients have individual care first in the wards or out-patient clinic to relieve symptoms and eliminate infections and are then chosen for class work when they are symptom-free, to continue the healing process and to prevent recurrences.

The class is a group of 10 or 12 patients who meet once a week and are taught the nature of the disease, its symptoms, complication and treatment.

The past experience of the clinic has been that many ulcer patients after initial treatment and relief of symptoms report once or twice and then fail to reappear until there is a recurrence of symptoms. We have long felt that the treatment in remissions is a crucial point in treatment which is often neglected. We all know that relief of pain is not a cure. It is usually easy to stop an attack in ulcer cases, to relieve pain, check vomiting, and make the patient comfortable within a short time. Our difficulties often begin when the patient is symptom-free and we still wish to carry out a regular schedule and continue some restriction.

When the diagnosis of ulcer is first made the patient is suffering and often frightened and is very willing to cooperate. Later the fear of the disease wears off when he finds himself promptly relieved and feeling entirely well. Both patient and doctor may get too lax and we have a recurrence. These dangers especially beset the hospital patient or less intelligent patient through ignorance or carelessness. This sort of thing is the bane of medical treatment which should be well ordered and progressive like that of diabetes. The symptom-free ulcer patient like the sugar-free diabetic is in a happy condition which must be continued at some sacrifice.

We have tried to combat the things which favor recurrence by a simple practical education. We believe that the patients who know the most, other things being equal, will live the longest and are most likely to avoid later illness and operation. We believe that the patients should not merely receive a diet list and some prescriptions. They should be taught the principles of the treatment of ulcer, its aim, nature, and the duration, and also its good results.

We outline the conditions which start

* Read at the Annual Meeting of the American Gastro-Enterological Association, Atlantic City, May6, 1930.

the disease and cause recurrence, the importance of infection, of nervous upsets, of wrong food, excess of tobacco, etc. We emphasize the conditions which promote healing and the necessity for playing the long game and not mistaking an intermission for a cure. We point out the cost of illness as an incentive to health and the prevention of recurrences.

In addition to knowledge the ulcer patient like the diabetic must have character in order to succeed and may need to be taught self-control and the willingness to make sacrifices for a good cause. We show that persons with quite severe symptoms or complications such as previous perforation or hemorrhage or obstruction of the pylorus, if they are honest and sensible and have reasonable self-control, may maintain health and comfort and keep steadily at work.

In emphasizing the importance of follow-up treatment, we often say that *ulcer cases are not cured in the hospital wards.* The patient goes into the hospital because of a complication or because he is not doing well on ambulatory treatment. The complication is relieved, the symptoms disappear, but the disease remains, and complete healing follows slowly and must be watched over for a long time.

THE REASON FOR CLASS WORK

Class work in ulcer, like other health classes, has seemed very useful for the following reasons: There is a great saving of time and effort. We avoid saying the same thing so many times to different persons and can take more time to explain in detail the reasons for our treatment. The patients learn from one another by questions and answers. The force of example is important. The more intelligent patients stimulate the others and develop an esprit de corps, a real competition in keeping well.

We have thought of the possibility of developing neurasthenia by so much talk about illness or of making some patients nervous by rehearsing the grim possibilities of ulcer; but in general we have found that the more the patients know about ulcer the less frightened they are and the more ready to follow the treatment.

The class is a course in treatment and in order to graduate the patient should know what kind of a diet is best, why frequent feedings are used, what drugs are most useful and why, how long it usually takes to heal an ulcer, and what leads to recurrences.

THE CLASS

The patients in our classes are practically all symptom-free. All types of ulcer are included. About two-thirds come from other out-patient departments of the hospital. This group includes the milder ones of shorter duration and showing less complications. About one-third come from the hospital wards, mostly from the medical side after several weeks stay in the hospital usually on a modified Sippy diet, including post-hemorrhage cases.

There is also a small but constantly increasing number of surgical cases after operation for perforation, pyloric obstruction, or repeated hemorrhage, or with recurrent symptoms after operation. The surgeons at present have not taken full advantage of their opportunities to send postoperative cases to the clinic for a careful follow-up. These postoperative cases are among the most faithful of our class, probably because they realize the seriousness of ulcer.

The patients from the wards are also quite a faithful group. They have learned that an ulcer may lay them up for periods of several weeks or more. The out-patient cases are the most likely to drift away as soon as they become symptom-free.

The vast majority are males of the wage-earning class and age. In a cosmopolitan city they are of all nationalities and of various grades of mental development.

They meet in small intimate classes of ten once a week for eight weeks for a twenty-minute informal talk by the doctor followed by ten minutes of open discussion

by members of the class. The list of talks is given below. Each time the following questionnaire is given to each member of the group which enables us to follow his progress.

Name Date
Weight today Weight last week
Pain If present, what relation to meal
How relieved Any change in character
Heart burn Vomiting Bowel movement, color
Are you taking powders? How often?
What diet are you on? Do you live up to it?
Any other complaints If yes, what?

If any digestive symptoms arise, the patient is referred back to the clinic for individual care. Any non-digestive symptoms are taken care of by the proper department. All patients after the class work report back to the Gastro-Intestinal Clinic for the usual follow-up.

SUBJECTS DISCUSSED DURING THE CLASS

What is an ulcer. Location of ulcers. Importance of knowing the location of ulcer (malignant degeneration of gastric ulcers). Multiple ulcers. Anatomy and physiology of stomach and duodenum.

Etiology of ulcer: Foci of infection, hyperacidity, tobacco.

Symptoms of ulcer: Chronicity, periodicity. Remissions do not denote cure. Heartburn, pain, food and soda relief. Recurrence and new ulcer. Vomiting, suspicious of pyloric obstruction. Hematemesis and tarry stools. Perforation and its danger.

Diagnosis: Symptoms, physical examination, *x*-ray, stomach contents and stools.

Treatment: Hospital versus ambulatory.

Ambulatory Treatment: Education, graded diet, no tobacco or alcohol, removal of foci of infection, alkalies, belladonna or atropine.

Surgical treatment for complications or suspicion of cancer must be followed by diet and medical management.

The ultimate cure depends upon the patient and his cooperation.

SUBJECT MATTER FOR TALKS

There are many valuable points in the treatment of ulcer which can be simply presented to a lay class such as the following:

Diet: A detailed discussion of simple foods, bland food, irritating foods, roughage, acid foods, those which stay long in the stomach; why some are used and others not. The dangers of experimenting with forbidden food and of breaking training at the suggestion of friends or family. Frequent feeding and the reason for it. The importance of a regular schedule, six or more feedings a day; how to manage it when at work. Proper methods of eating, slow thorough chewing, the necessity of plenty of good clean teeth.

Food values: Limitation of diet is not starvation or "weakening." Patients often gain weight if their work is not too heavy. Milk, cream, butter, egg, cereals, bread are very nutritious. Many of the low value foods are left out such as raw greens and fruit, broths, etc. The fallacy of meat being a "strong food." Compare lean beef at 800 calories per pound with cereal at 1600 calories per pound.

The cost of the ulcer diet is not above the average. Milk, egg, cereals, and bread are used freely and expensive meat, raw greens, and fruit left in the background.

Vitamines, their importance, where found, and how much are needed. Salt and condiments. The effect of alcohol on the stomach.

It takes some skill and care to live contentedly and successfully on an ulcer diet for the first six months.

Hygiene: The effect of rush, strain, anger, worry, etc.; the benefits of rest, sleep, outdoor life, fun, vacation. Physical exercise, the kind and when to take it; heavy jobs, gymnasium work, athletic contests. Care of the teeth, their importance for proper chewing, infection. The effect of tobacco on the stomach. Change in

body weight which occurs during treatment. Care of the bowels; constipation on the bland diet and how to avoid it; the use of magnesia, mineral oil or irritating laxative.

Drugs: Alkaline powders and tablets. How to mix cheap Sippy powders at home. Belladonna.

The Complications of Ulcer: How to recognize bleeding. What to do first. The seriousness of perforation, the importance of early operation. Early treatment of any recurrent symptoms.

Surgery: Its value and limitations. How to avoid it. Surgery is only for complications or for failure of medical treatment. The need of follow-up treatment after surgery.

RESULTS

The classes are well attended. Seven out of ten attend every session although they have a job and the classes are during working hours. One or two may drop out after the first or second session and there are one or two tardy ones. The more intelligent members of the various groups have clearly shown that they highly appreciate the class work and recognize its value. There is a certain esprit de corps developed in each group, a friendly rivalry in good health, and when they go back to the various sections of the community, they become to a certain extent missionaries of better health and food habits.

As the number of out groups increases, we may have reunions at three or six months' intervals in order to keep in touch with them for years instead of weeks or months. In larger clinics possibly, it would be wise to make different kinds of groups; simple ulcers, bleeding cases, postoperative cases, etc., and to vary the talks accordingly. We have not done this.

In our class work we find the force of example very useful. Some patients are more conscientious than others and stimulate and encourage the latter to "play the game." Some of the less intelligent patients who make unconscious mistakes in diet are sometimes laughed at by the others and thus shamed into taking better care of themselves. Many points about food are brought out in the discussions which saves much repetition and loss of time. All the patients get more accurate and detailed instruction about foods. It is customary in our clinic and probably in most others to give the patient a printed sheet telling which foods are allowed and which prohibited, which he must then interpret and apply to the best of his ability. The result is sometimes a one-sided diet, sometimes diet deficiencies which slow the healing of the ulcer. The members of our class have their diets analyzed and explained in detail. The dangers of low vitamines for a long period of time are shown and simple ways to avoid deficiency diseases are given. At the end of a short period of talks, the patient knows much more about his diet and treatment and is much more willing to follow it.

It is very encouraging to see patients who were indifferent to the removal of various foci of infection come forward and request that infected teeth be treated or removed, or that tonsils be removed, or say that they are now ready for a needed operation on an antrum which they had previously refused.

It is instructive in the discussion period to find out what the ulcer patients are thinking about. Their first and foremost question is: When is an ulcer healed and how can we tell the time? The next most frequent question is about diet, the safety of taking certain foods of all kinds. The importance of frequent feeding and the ways and means of carrying it out in various trades and occupations comes in for a great deal of discussion. The dangers and frequency of malignant degeneration of ulcer seems to have made a deep impression on the lay mind. The size of an ulcer and the number of ulcers in an individual case is frequently discussed. The failure of a surgeon to tell his patient the importance of postoperative diet and follow-up is often criticized, especially by the postoperative

patients who have had recurrences. Other questions are: What is the best procedure if a patient should have a second hemorrhage? Is a recurrence of symptoms due to a new ulcer or an old ulcer? What is the value of the roentgen ray in diagnosing an ulcer and proving its cure, etc?

The physician who leads the class also learns something. In addition to finding out what the patients are thinking about, he trains himself to present the subject of ulcer in a popular manner and also gets an opportunity to watch a group of cases for a long period.

The results of our class work have been for the physicians closer contact with the symptom-free ulcer patients and a better understanding of their points of view, and for the patients clearer and better ideas derived from discussion of the many practical ulcer problems, and better cooperation which we believe will lead to better end-results.

DISCUSSION

Dr. Lichty: I think this is a very important paper, and one which should be given careful consideration. It seems to me that, too often, in cases of this kind, the great object of the doctor is to hurry his patient through and get him to the surgeon, and, theoretically "cured," without stopping to think of what can be done for him medically. He is not interested in those small, trivial things, which mean so much to the patient at that time, and which will, perhaps, mean a great deal more to him, later on. I believe that the benefit to be derived by the patients is very great, and further, you can help the interns, or residents, because they will have a better chance to observe these cases. In most clinics, you are usually dealing largely with end-results. Prophylaxis is not given the attention which is due the patient suffering from the early symptoms of digestive disturbances. Some of the disasters often met by the peptic ulcer patient are altogether too prevalent.

Dr. Smithies: This scheme was carried out at Chicago, in the Augustana Hospital, before the War, and I believe Dr. White visited my clinic then. It worked very nicely. We had a Sunday morning class, and got a good attendance. We found that many of these patients had a wide variety of ideas on the question of ulceration, its cause, and its cure, and consequences. We tried to educate them in a rational manner. There was a certain amount of danger in some of this work, of developing in these cases, a sort of cancerphobia. Patients were apt, if one did not watch them, to come to associate ulcer with cancer. When we could impress upon them the fact that, if a duodenal ulcer existed, and not a gastric ulcer, they would rarely have cancer and that only about 4 or 5 per cent of gastric ulcers might possibly result in cancer we felt that we had accomplished a big thing. However when that assurance was driven home many patients got quite careless and paid relatively little attention to their habits in the comfortable phases of their ulcer life. One of our most difficult tasks was to talk positively, because we, ourselves were too conscious of the many things not known about ulcer.

NEW INCISION FOR OPERATIONS UPON THE URINARY BLADDER*

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INTRODUCTION

OUR attention was called to the advantages of a transverse incision in the operation of suprapubic cystostomy by Dr. B. W. Wright of Los Angeles in his discussion of one of the papers at the last meeting of the American Urological Association in Seattle, Wash. His description of MacGowan's method so impressed us that we utilized this method upon the very first patient operated upon after our return from the meeting.

The exposure was so much superior to the ordinary midline incision that we became interested immediately and modified it to suit our needs.

LITERATURE

The employment of a transverse incision for exposure of the bladder seems to have originated in Trendelenburg's Clinic at Bonn, sometime during the last quarter of the 19th century. The method was described at length by Eigenbrodt in 1888[1] and by Trendelenburg himself in an article published in 1890.[2] The use of this incision seems to have been limited largely to gynecological work, and it was applied to female patients suffering from vesical growths rather as an extension of the technique to operations upon the genital tract in women. Stoeckel[3] advocates an exposure of vesical growths in the female which embodies most of the features of Trendelenburg's method, including the transverse incision. In the first edition of his "Operative Gynecology" (1898) Howard Kelly mentions the possibility of using the transverse incision for removing bladder growths, but deprecates it because of the increased difficulty of closing such a wound, although acknowledging the advantages of the greater space and vision it affords. Seventeen years later, his opinion of this incision seems to have risen, for in another book[4] which he wrote in conjunction with Burnam in 1914, four pages, with elaborate illustrations, are devoted to bladder exposure by transverse suprapubic incision.

The paper written by Granville MacGowan[5] was probably produced at the same period when Kelly and Burnam were at work upon their book. MacGowan specifically disclaimed any originality in his use of the transverse incision, but added that he had never encountered any description of the precise procedure for suprapubic cystotomy which he was describing. Certainly it would appear that he was among the first to apply this incision as a routine outside the limits of the gynecological field.

According to Eigenbrodt, Trendelenburg first employed the customary median incision when dealing with vesical calculus or other pathologic conditions in the bladder which required operation. Later the advantages of the transverse incision above the symphysis became more apparent. The transverse incision was suggested by two calculus cases both the subjects of operation being fat with pendulous abdomens. The transverse incision proved very successful, inasmuch as the prevesical peritoneum could be avoided with more ease and certainty, and a far better view of the vesical cavity was to be had. Drainage was available at each end, and the gaping incision could be reduced to controllable size by use of properly placed lateral sutures. The technique was as follows: After the skin and cutaneous fat are divided, the muscle tissue being exposed, muscle and fascia being divided as close as

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possible to their insertion, the index finger of the left hand is pressed against the recti and the knife carried close to the superior and posterior surface of the symphysis. Tendons and fascia are easily parted, exposing the prevesical fat. By blunt dissection the overlying structures are freed from the bladder, and lifted backward and upward care being taken to avoid the prevesical fold of peritoneum. The incision through the skin and fascia may be anywhere from 3 to 8 cm. in length, according to the nature and purpose of the bladder intervention.

MacGowan's procedure differs from the preceding principally in his method of staying the wound as soon as sufficient exposure of the bladder has been accomplished. He prefers to incise the bladder wall longitudinally, though stating that a transverse or longitudinal incision may be used. As soon as the bladder is opened as widely as desired, 2 to 4 sutures are to be inserted through all its coats and muscle and fascia on each side, so that the space in front of the bladder and between it and the pubic bones shall not be disturbed by subsequent manipulations. If two of these stitches are placed in front, one on each side of the median line, and the bladder is held up by two other lateral stitches, it is kept during the whole course of the operation in such relation to its surroundings that they do not become infected.

Examination of the literature of bladder surgery which has appeared since MacGowan's publication does not produce evidence of especial interest in the advantages offered by the transverse approach. A number of operators appear to have used it in resecting diverticula, and it is mentioned quite frequently in relation to gynecological procedures; but in most reports on bladder surgery, if the type of incision is mentioned at all, it will prove to have been the usual one in the midline. To be sure, the fifth volume of Bickham's "Operative Surgery,"[6] contains an extended description of transverse suprapubic cystotomy according to the method of Pfannenstiel. Pfannenstiel's curved suprapubic incision was, however, first introduced as an adjunct to Cesarean section, and is still primarily so employed. The procedure advocated by Bickham divides not only the skin and fascia by a transversely curved incision, but the abdominal aponeuroses and muscles by a straight transverse incision, and finally the bladder wall itself is opened transversely. The statement is made that this incision is suitable only when the very freest access must be obtained, as in the presence of very large tumors. Against the ease of approach must be weighed the damage apt to result from transverse division of the abdominal wall.

OUR TECHNIQUE

It is our impression that it is most important to have the drainage tube inserted into the highest possible point of the vesical fundus and that the course of the fistula remaining after removal of the drainage tube should be obliquely upward to the highest possible point in the skin incision. This position will aid materially in the rapid closing of the wound because the pressure of abdominal contents upon the oblique passage will aid in its closure by mechanical pressure.

An important consideration lies in the fact that if the fistula and its resulting scar are high and subsequent operation is necessary the peritoneum is held well up out of harm's way and the second incision below this point is unattended with the danger of penetrating the peritoneum.

With these facts in mind we decided that the most suitable incision was an inverted v incision, the apex of which should be well above the point to which the dome of the distended bladder would reach. It is therefore our practice in doing an ordinary suprapubic cystostomy to incise with the apex of the inverted v at a point about three-fourths of the distance between the symphysis pubis and umbilicus.

The incision is deepened through the skin and subcutaneous tissue, the sheath

of the recti on each side is incised and if the recti are firm, strong muscles they are cut across either partially or entirely as directly to the highest point of the vesical fundus.

By careful blunt dissection the peri-

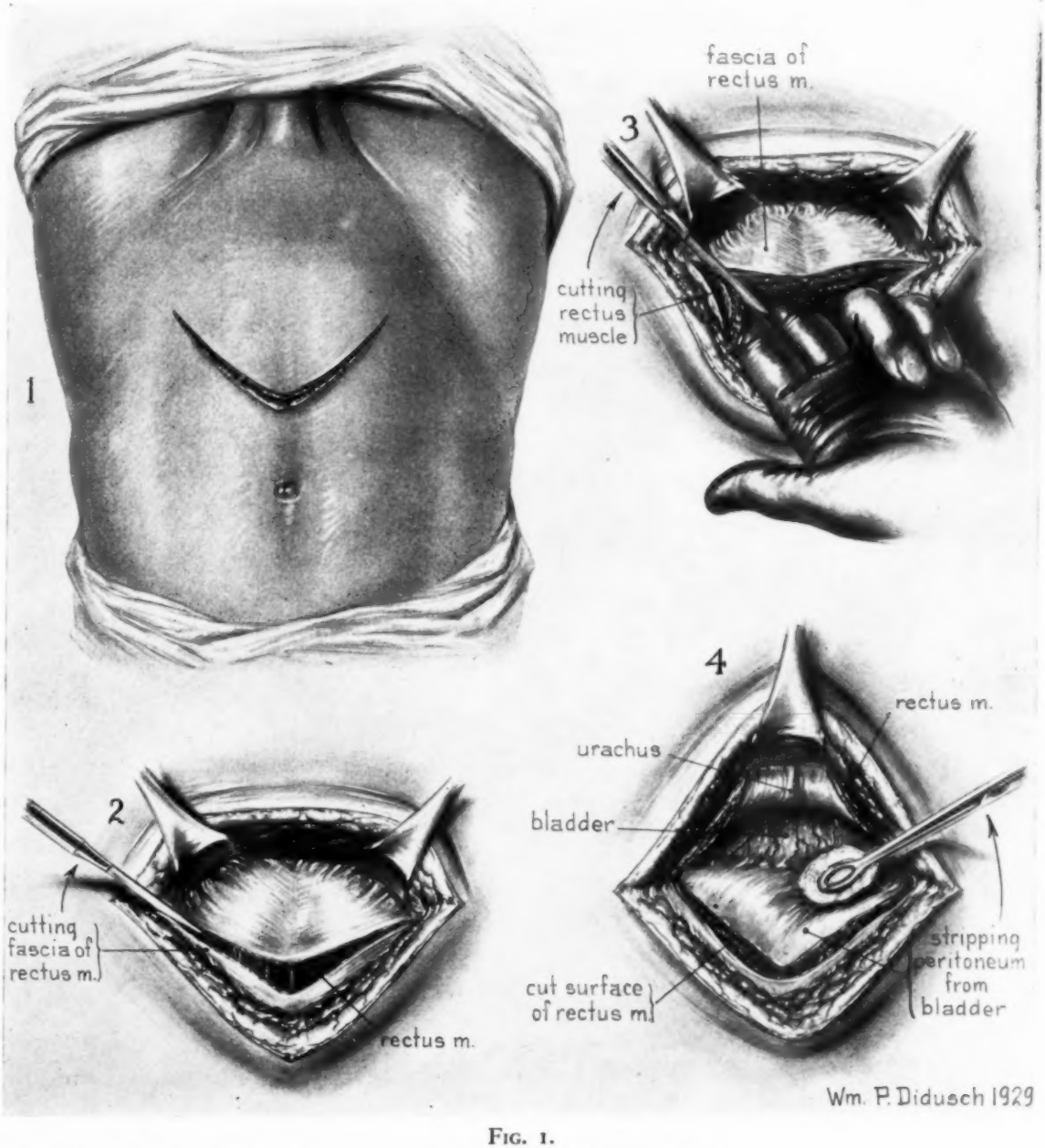

Fig. 1.

1. Location and shape of usual inverted V incision for bladder operations.
2. Incision is deepened through fascia of rectus muscle on each side.
3. Muscle itself may be cut through as in this illustration or separated and retracted as deemed necessary.
4. Urachus is followed down until it reaches top of bladder; then dissection is carried back, exposing vault of that viscus, by pushing back the peritoneum. Care is taken not to penetrate the space of Retzius.

the case may demand. The obliterated hypogastric vessels and the urachus are encountered and by dissecting along the latter structure, with care, one is led toneum may be easily separated from the bladder wall without approaching, even, the space of Retzius. On account of the fact that there is no excavation necessary

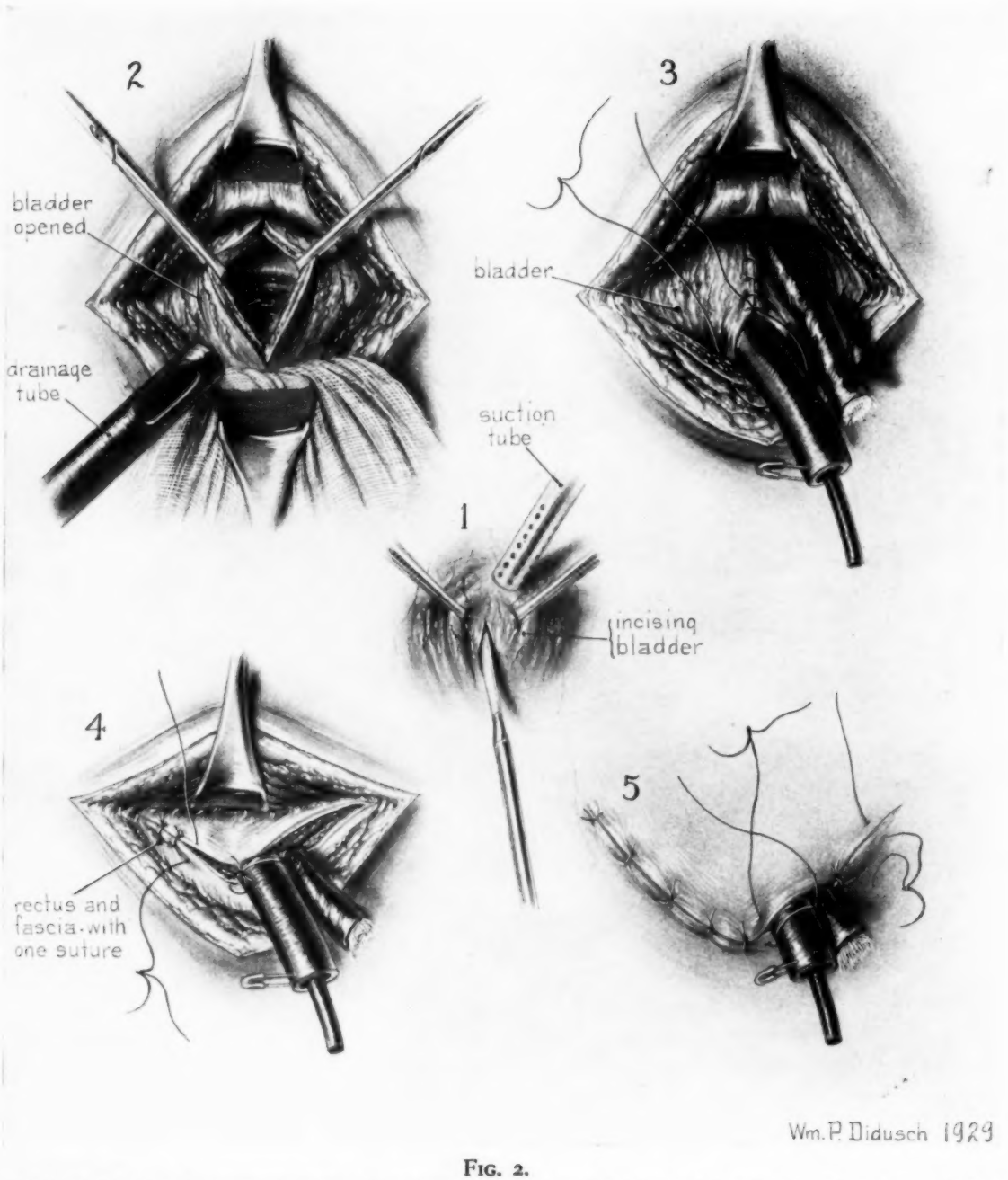

Fig. 2.

1. Wall of bladder is grasped with Allis clamps, incised and fluid remaining in that viscus is carried away by a suction tube.

2. Bladder wall is incised to desired length and if it is a case of excision of tumor, diverticulum or any other operative procedure this is accomplished.

3. Kenyon double suction tube is then fixed at highest point of bladder incision by a catgut suture tied around it and sutured at apex of V. Cigarette drain is fixed in position over line of incision.

4. Layers of muscle and fascia are replaced with plain catgut.

5. Skin is sutured with silkworm gut and Kenyon tube fixed with one suture. By fixing tube at bladder and skin the dead space is eliminated and tube is brought through abdominal wall obliquely.

behind the symphysis pubis we have not found it necessary to stitch the bladder to the rectus as MacGowan and his followers do. This is due to the high incision which we employ.

The bladder, having been exposed as herein described and recognized by the richness of its blood supply and its muscle fibers, is then grasped by Allis clamps incised between them and its contents removed by a suction apparatus. A double suction tube is then fixed at the highest point in the vesical incision with plain catgut and then sutured to the apex of the incision through the fascia. This establishes an oblique passage through the abdominal wall for the drainage tube and its succeeding fistula. A small cigarette drain is inserted along the suture line of the bladder.

The fibers of the recti are approximated with plain interrupted catgut stitches and the fascial coverings of the recti are sutured with continuous plain catgut. The skin is closed in the usual manner with interrupted silkworm gut sutures one of which is tied around the double suction tube fixing its position at the surface.

In cases requiring more efficient exposure of the bladder such as resection of vesical neoplasm with transplantation of the ureter or resection of vesical diverticula it is found useful to make the incision midway between the umbilicus and symphysis. In this manner the entire pelvis is laid open and the exposure is very much superior to any that the author has used or seen. In fact even the most difficult operations in the pelvis are rendered infinitely more simple by utilizing this incision.

CITATION OF CASES

There were 45 consecutive cases of patients studied in this series; the youngest was twenty-four years of age, the oldest eighty-four years, the average age being 57.46 years.

Of these patients 30 were operated upon for the purpose of establishing suprapubic drainage as a preliminary to prostatectomy, 10 were subjected to resection of vesical tumors. Large vesical calculi were removed from 2. There were 2 plastic operations upon the lower end of the ureters and 1 had a vesical diverticulum.

The type of drainage employed following this operation was the Kenyon double suction tube in 34 cases; gravity was employed in 9 cases and urethral catheter drainage in 2 cases.

Healing of the suprapubic wound occurred without infection in 39 cases. In 5 cases there was a transient infection lasting a few days only and in 1 case this was extended to ten days. In no case was there extensive infection and nothing resembling the old fashioned pelvic cellulitis was encountered at all.

After removal of the suprapubic tube the closing of the fistula occurred much more rapidly than in any of the other methods tried by us. The quickest closing was in three days, the large majority were healed in ten days and the remainder before the eighteenth day with one exception and this one required fifty-three days. The average for all of the cases was 11.9 days.

SUMMARY OF RESULTS

The most satisfying fact in the employment of this new modification of an old incision is in the marvelous exposure obtained for operations upon the urinary bladder. In cases requiring wide dissection of the vesical fundus it is indispensable.

In one case (T. C.) in which there were stones in the lower ends of both ureters, too large to pass, and upon which plastic operations were done this exposure was entirely satisfactory.

In doing a two-stage suprapubic prostatectomy the inverted v incision is practiced for the first operation and at the second a linear incision may be extended from the fistulous tract down to the symphysis pubis through virgin tissue which gives much more room than can be ordinarily obtained and makes proper visualization of the prostatic bed possible by allowing retraction of the tissues.

The fact that in this procedure there is no entrance into the space of Retzius prevents pelvic cellulitus and is an additional advantage resulting from this type of suprapubic operation upon the urinary bladder.

When utilized in cases of diverticulectomy, resection of wide areas of vesical tissue, with or without transplantation of the ureter, this type of incision gives such a splendid visualization of the pelvic structures that it seems to us to be indispensable.

CONCLUSIONS

1. This operation is easily accomplished under regional anesthesia.

2. The inverted v allows the drainage tube to be placed high in the fundus of the bladder and high in the skin wound, to course obliquely through the abdominal wall. This makes for rapidly healing fistulae.

3. In case a secondary operation is to be performed the incision may extend from the fistulous tract to the symphysis through virgin tissue without fear of injuring the peritoneum.

4. The danger of pelvic cellulitis is eliminated because the space of Retzius is not opened.

5. In this series of 45 cases there have been only 6 cases of infection of the suprapubic wound; all others have healed by primary intention. The average time required for the suprapubic fistula to close was 11.9 days.

6. The view obtained by the utilization of this incision is so satisfactory that the most extensive vesical resections and plastic operations upon the lower ends of the ureters are rendered infinitely easier for the operator as compared with the usual approach.

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THE EVALUATION OF ELECTROSURGERY IN THE TREATMENT OF CANCER*

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WHEN the nature of tumor growth was but little understood, mechanical removal with caustic, cautery or knife represented the most efficient therapeutic procedure. Variations in the course of the disease were recognized clinically but these differences were not correlated with the underlying pathological process. Neither successes nor failures could be explained upon a sound or logical basis. For many generations the treatment of cancer remained entirely empirical.

Within the past few years, however, experimental evidence in the field of transplantable tumors has yielded new information and as our knowledge of the disease has increased so our treatment has become more complex. As microscopical investigations have unfolded important pathological data there has been developed a more intimate correlation between the pathological and clinical phases of cancer which has led to a more rational scheme of therapy.

More recently research has thrown considerable light on cancer as a process. Thus Cramer,[1] of the Imperial Cancer Research Laboratories, reports a series of experiments which may prove to be of the highest importance. Cramer has shown that if a large area of the skin of a mouse is subjected to chronic irritation by tar-painting the development of malignant growth is confined to a very small portion of that area. If papillomata have developed in the area together with the malignant growth, they retain their benign character. If, after the removal of the malignant growth, the area of skin in which no malignant development has taken place is preserved, it is found that in that area malignant growth may develop again in a new center, either beginning at the base of a papilloma which was left behind or starting as an entirely new growth. Removal of the second malignant tumor has sometimes been followed by the development of a third malignant growth. In further experiments in which irritation was applied directly to the base of a papilloma immediate malignant development was observed in six animals.

Cramer concludes that these observations supply evidence that the development of a carcinoma is not entirely dependent upon changes in the epithelial cells but that there are local inhibitory factors capable of keeping the malignant development in check and that the immediate cause of the genesis of a carcinoma may be the removal of a local inhibition residing in tissue elements other than epithelial cells. The process of carcinogenesis is therefore not a continuous one but is composed of two phases: a process of long duration which induces a state of "potential malignancy" kept in check by a local resistance and, secondly, a local breaking down of this resistance which allows of an immediate malignant development of the "potentially malignant" cells.

The earliest stages of human cancer have been shown by Sir Lenthal Cheatle[2] in his sections of whole breasts. Cheatle has been able to demonstrate that the epithelial cells lining the ducts and acini of the breast undergo normal desquamation and that the first stage in the cancer process is the formation of papillomata. This benign papillomatous stage is followed by a stage in which the epithelial cells are atypical but confined within their normal boundaries; the third and final stage is the development of carcinoma. These three stages in the development of carcinoma in the human are comparable to the production of tar cancer in mice. A

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similar sequence of events has been demonstrated in the production of rectal carcinoma by Cuthbert-Dukes.[3] From these researches it would appear that carcinoma is a process that begins usually as a benign epithelial proliferation and ends, if the process continues, in the formation of a malignant tumor.

Advances in the study of cancer have been accompanied by important developments in the clinical and pathological phases of the disease. An important step forward was taken with the introduction and the progress toward perfecting the application of roentgen rays and radium. The development of radiation in the treatment of cancer has, in addition to its therapeutic value, yielded important information in regard to the biology of tumor growth. Comparison of histologic structure of tumors and their response to radiation has reached a stage where it is now possible, in most instances, to predict from histological examination of the tumor the response it may be expected to make to radiation.

Pathologists for many years have been seeking to determine the degree of malignancy of tumors from the histologic structure and Broders[4] has found that a definite relationship does exist between degree of differentiation and prognosis under surgical treatment. His conclusions have been confirmed by Martzloff,[5,6] Greenough[7] and others and although some pathologists have disputed the value of the method it appears that their criticism is based upon isolated exceptions to the rule. My own clinical experience has led me to believe that knowledge of the histologic structure of a tumor may be of great practical value in determining the proper form of therapy.

The law of Bergonié and Thibaudeau that the less differentiated a tumor the more radiosensitive it is has had clinical confirmation in the report of Healy and Cutler[8] who, investigating 200 cases of carcinoma of the cervix, were able to demonstrate that the anaplastic group, with the worst prognosis under surgical measures, offered the best prognosis under adequate radiation therapy. The reason for this is the marked radiosensitivity of the undifferentiated, anaplastic cells.

Failure to appreciate the effects of the histologic structure on prognosis has led in the past and must lead in the future to misconceptions and erroneous deductions, resulting in the issuance of statistics of little scientific value. In a recent editorial in *Surgery, Gynecology and Obstetrics* Dr. W. J. Mayo emphasizes the importance of the microscopic study of malignant lesions as a basis for treatment. He confirms the view that a lesion of the most malignant grade which does not offer sufficient hope of cure to justify surgical measures may be susceptible to radiotherapy or heat. To arrive at the definite knowledge of the nature of the lesion, which alone enables us to prescribe treatment scientifically, Dr. Mayo commends the frozen section of fresh tissue which can be prepared rapidly, that is, in time to be of benefit to the patient, and he adds that "fresh frozen section has come into its own."

Scalpel incision of healthy, intact tissues for the removal of biopsies is conceded to be accompanied by a certain element of danger, the danger being lessened when the lesion is ulcerated. Since the advent of the endotherm knife,[9] or cutting current, the removal of tissue for biopsy is no longer looked upon as a hazardous procedure.

With the biopsy electrode a small fragment of tissue may be excised with the greatest facility and safety. The sealing of lymphatics and the elimination of trauma are the two important advantages of the new method. The crushing of the minute specimen which accompanies the use of forceps is eliminated so that it is now possible with the rapid frozen section method to have specimens taken, frozen, cut and stained within a very few minutes. In most cases this can be carried out as an office routine except in tissues too friable for freezing, when a rapid paraffin section

must be resorted to. I have followed this office procedure in a series of cases and have found it consistently certain, rapid and helpful. It must be borne in mind, however, that a negative biopsy does not exclude the possibility of the presence of malignant disease.

A formidable difficulty that arises in the evaluation of different methods of treatment is due to the extreme variations in the natural course of untreated malignant disease. Certain untreated cancers may run a course of many years. Daland[10] has shown in his report of 100 cases of untreated breast cancer an average life of 3⅓ years.

Factors that determine the results of treatment in any given case of malignant disease are multiple but the most important are:

(1) The extent of the disease,

(2) The degree of malignancy of the tumor,

(3) The radiosensitivity of the lesion,

(4) Accessibility to treatment and general condition of the patient.

Frequently a patient suffering from an extensive malignant growth has remained in good general condition. Such a patient, though considered surgically inoperable, offers a fair prognosis if properly treated.

The extent of the disease may limit or prohibit the procedure of scalpel surgery but two new methods now available offer considerable hope in advanced cases which would otherwise be regarded as hopeless. When an advanced lesion is radiosensitive irradiation may yield definite palliation and in many instances surprisingly good results are observed. Furthermore, it cannot be doubted that irradiation of highly malignant lesions (grades III and IV of Broders) by destroying the most radiosensitive elements renders the lesion more susceptible to treatment by electrosurgery.

On the other hand, when a lesion is both advanced and radioresistant neither scalpel nor radiation has much to offer. To this rather large group of cases electrosurgery or endothermy is peculiarly adapted. Through the surgical application of endogenous heat it is possible to destroy and remove extensive lesions with a degree of protection not provided by any other agent. Particularly in the treatment of those radioresistant lesions that are notoriously prone to recur after scalpel excision, such as squamous carcinoma, neurogenic sarcoma and melanoma has endothermy won for itself a unique place. Not alone in advanced radioresistant lesions should endothermy be held a dependable adjunct but its merits render it yet more dependable in the treatment of beginning cancer and precancerous lesions. Too often is this method fallaciously regarded only as a means of last resort.

The profession is familiar with the reasons for the failure of scalpel surgery in many malignant lesions. We know that metastases and recurrences following scalpel interference do not just *happen;* they follow logically, scientifically.

In a brilliantly informing article on "The Relative Values of Surgery and Radiotherapy," Dr. Mayo[11] pointed out that only particles of molecular size such as the amino-acids, sugar and other crystalloids are absorbed directly through the vascular capillaries, while colloids and large particles are picked up by the lymphatics. This makes clear the threat of transplantation which lies in the scalpel's severance of lymphatics and demonstrates the advantages of incision by the cutting current which sterilizes and seals lymphatics as it cuts.

This quality of protection against mechanical implantation of malignant cells is inherent in a proper technique of endothermy whereby we have two distinct procedures: first, to excise the lesion with the endotherm knife or cutting current and, second, to destroy the lesion in situ first by desiccation or coagulation and then immediately to remove it as dead tissue instead of as viable cells.

The lightest current, the monopolar, which dehydrates the area to which it is applied, was perfected by Dr. W. L.

Clark[12] of Philadelphia who found that there is a point between hyperemia and incineration which may be reached and sustained in the treatment of tissue. He calls this the desiccation point. Its use is indicated in small, superficial, localized lesions which are accessible or may be made accessible by the endotherm knife. There is possible the greatest delicacy of its application which assures a soft, pliable scar free of fibrosis and telangiectasis. The range of its usefulness is very great.

The second current, the bipolar or coagulating, is the current which has been most used and over the longest period of years. A malignant lesion which is coagulated is a destroyed lesion. Sterilizing and sealing of lymphatics minimize the likelihood of metastasis and recurrence; capping of afferent, sensory nerve endings diminishes surgical shock; decreasing hemorrhage by sealing smaller blood vessels, all these benefits follow the use of each of the currents. The third current, the endotherm knife, is most recent in point of perfection and use, having been presented by the writer before the New York State Medical Society only in 1924.

Endothermy can be used in repeated treatments without prejudice to the patient but the lesion treated should be destroyed and removed in a single operation. There is no injury to the surrounding tissues for the reason that endothermy is at all times under the control of the operator to administer just as much or just as little as his experience has taught him is proper. A subsequent nodule or induration may be destroyed and removed on precisely the same terms as the first lesion, if endothermy is the remedial agent.

Malignant growths in cavities such as the antrum, larynx, bladder, etc., may be made accessible by incising with the endotherm knife and then desiccated or coagulated as may be indicated. Schmiegelow of Copenhagen has reported exceptional results in treatment of tumors of the larynx and Beer's success in the treatment of bladder tumors is well known. Cushing of Boston reports splendid results with the monopolar and the cutting currents in the treatment of tumors of the brain. From Kelly of Baltimore have come interesting reports of the value of electrosurgery in abdominal conditions. Berven of the Radiumhemmet in Stockholm is treating carcinoma of the vulva exclusively with endothermy; Holmgren of the same institute is handling his cases of carcinoma of the antrum with endothermy alone or in combination with external radiation. Blumenthal of the Charité Hospital in Berlin is removing primary operable carcinoma of the breast by the cutting current with subsequent radiation. Sampson-Handley of London in a recent report concludes: "For the past year I have operated upon most of my cases of breast cancer by the electric needle instead of the knife . . . The method presents great and appealing advantages."

Thus is the weight of the evidence increased and although at first the obvious benefits of treating malignant lesions by electrosurgery surprised and delighted both operator and patient, the experience of many years has shown that results here, as elsewhere in this law-governed universe, move logically from cause to effect.

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VALUE OF SURFACE-AREA PROPORTIONS IN THE PROGNOSIS OF CUTANEOUS BURNS AND SCALDS*

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PRIMARILY, the seriousness of cutaneous burns and scalds (except those caused by radium and *x*-rays) depends on the extent, depth and location of the injury. Internal pathology, in its recognizable manifestations, may become of paramount importance; but this is later, and usually is predictable from the external damage.

It is generally recognized that the extent of the burned surface is of greater prognostic importance than its depth. The nature of these important injuries is such, however, that descriptive classification is impossible, even, or especially, when exact direct measurements are available. Hence the old view prevailed until recently, that this is "a matter which necessarily eludes formal classification."[1]

But, and this has not been noted sufficiently, chief prognostic importance does not rest with the size of the burned area per se. Healing-time does largely depend upon the amount of injured surface: *Recovery depends upon the relative amount of uninjured and functioning surface which remains.* For example, a first and second degree burn totaling 5000 sq. cm. in a child having a total body surface 10,000 sq. cm. would prove fatal; but in a man having a total body surface of 20,000 sq. cm., the same extent and depth of involvement would be of far less serious import.

In 1924 I[2] pointed out that from a knowledge of surface-area proportions of the head, the trunk, and the upper and lower extremities and their natural subdivisions, the extensiveness of cutaneous lesions could be estimated and stated in *percentage*. For example, having established that the head area is 6.5 per cent of the total body surface, a burn involving one-half of the head must be a 3.25 per cent burn. Whenever burns involve several parts of the body, the involvement of each part can be estimated separately and the sum of these involvements is the total per cent burned.

By a slight alteration of the true surface-area proportions, the factor of the location of the injury as it affects prognosis can be included in the single numerical expression, under per cent of body burned. By giving to the trunk the decimal percentages of the other parts, the proportions are adjusted to the greater seriousness of burns of the chest, abdomen and perineal region. At the same time the figures are simplified. The proportions to be remembered are: head, 6 per cent; upper extremities, 18 per cent; trunk, 38 per cent; lower extremities, 38 per cent. The neck is included with the head, the genitals with the trunk, and the buttocks with the thighs. Of the lower extremities, the feet are 1/6, the legs 1/3 (2/6), the thighs 1/2 (3/6).

It should be remembered that the altered proportions are not the true surface-area proportions of the body parts. For that matter, there are slight differences between normal individuals, although for the present purpose these can well be disregarded.

Since this method involves no measurements whatever, and is a free, reasoned estimate based on inspection of the burned area and knowledge of the bodily proportions, to insist upon decimal proportions implies a degree of accuracy beyond what the method affords. The "corrected" proportions are simple and fulfill prognostic requirements. Greater accuracy would be of no particular benefit clinically.

In children the proportions are different. The proportions of head and lower extremities vary considerably, and progressively, with age. Measurements of nearly 500

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children confirm the value of the following rule which I proposed for ascertaining the proportions at any given age up to twelve: trunk 40 per cent, upper extremities 16 per cent. For head and lower extremities, subtract age in years from 12 and add the remainder to the number expressing the adult proportion for the head (6). Subtract the same amount from the number expressing the adult proportion for the lower extremities (38).

The proportions so obtained are already corrected to the greater seriousness of burns of the trunk.

I would call attention to the fact, with which I became acquainted about a year ago, that in 1902 Stephan Weidenfeld[3] proposed the use of surface-area ratios for this very purpose. He obtained his ratios from actual measurements of the surfaces of three adults and two children. Considering Weidenfeld's many valuable contributions to the subject of cutaneous burns, the fact that his method did not come into a more general use at that time is rather surprising. I can only attribute this to the difficulty of remembering and calculating from his ratios. In children, his ratios are only for those of two and four years.

In the literature of the past five years there have been a number of references to "the Berkow method." In view of Weidenfeld's priority a combination of names would be fairer.

The method, as suggested by me, has been checked with actual measurements, by Davidson.[4] The results, he found, "have agreed within a very reasonable limit of error." He states also that "measuring is of little value except to get a figure of total area involved." Actual area, as noted previously, is of value chiefly in studying the rate of healing. In this connection the exact work of Carrel and Hartmann[5] and Du Nouy[6] has not, it seems to me, received sufficient attention from clinicians. This shows that the rate of healing of wounds can be expressed by a mathematical equation. From the size of the wound and the age of the patient the rate of cicatrization can be predicted. Infection (clinical, as against the mere presence of a few bacteria) slows up the normal progress of the wound.

By employing the height-weight formula of du Bois,[7] it is possible to obtain from the estimate of *proportion* of surface involved a fairly accurate figure for the *actual* surface involvement.

Now, the difference between the per cent involved and 100 per cent (the total surface) is the per cent of unburned surface. This is the true basis for prognosis as to life. Tauber[8] suggests that about 20 per cent should be added to the actual (?) burned area in making an estimate of the area of skin that is really not functioning, "as about that area of adjacent unburned tissue is for the time being unable to functionate properly and is completely out of commission." This interesting suggestion has not, to my knowledge, been put to experimental or clinical proof.

The largest per cent of body surface involvement *with recovery* is a burn of 48 per cent reported by Davidson[9] in his classic paper on the tannic acid treatment. The patient was a white man, aged forty-nine. Most of the burn was first degree, some second degree. Treatment was 2.5 per cent tannic acid solution locally, 500 c.c. of 5 per cent glucose intravenously and glucose by rectum. Fluids were forced to 10,000 c.c. daily. The patient was discharged from Henry Ford Hospital on the twentieth day after the accident.

In the same series death followed a burn involving 53 per cent of the body surface.

In children, Seeger[10] reports that

> . . . the greatest amount of skin area involved in a patient who recovered was 30 per cent, there being 2 in this group. Two others who recovered had burns involving 27 per cent of the body surface . . . One infant one and one-half years old recovered following a burn of 20 per cent of the body surface. With 1 exception, all of those who died had involvement of 30 per cent or more of the skin area.

Local treatment was with tannic acid.

CONCLUSIONS

1. For purposes of record, comparison, and prognosis, a definite, numerical statement of the relative amount of surface area burned is essential.

2. The surface-area proportions have proved their clinical value for this purpose.

3. The priority of Weidenfeld in recommending this method is brought forward. Basically his conception is identical with my own, which I consider to be better adapted to clinical requirements. The use of both names in the designation is suggested.

4. If the amount of body surface is determined from the patient's height and weight, by the height-weight formula of du Bois or from a table or nomograph based on this formula, the estimated per cent of involvement can be used to determine the actual area burned. This may be important in prognosing the healing time.

5. The prognosis as to life depends upon the per cent of unburned and functioning surface that remains. This is found by subtracting the estimated per cent of burn from 100.

6. From the literature, cases are cited in which recovery ensued after burns involving 48 per cent of the body surface in an adult and 30 per cent in each of two children. Further reports of this nature would be of inestimable value for prognosis.

TABLE 1

COMPARISON OF ADULT RATIOS ACCORDING TO WIEDENFELD WITH ADULT PROPORTIONS ACCORDING TO BERKOW

Parts	Ratios (Wiedenfeld)*	Proportions (Berkow)† (Per Cent)	Parts
Head	1:21	6	Head (including neck)
Neck	1:47		
Trunk	1:3.7	38 (anterior surface 20) (posterior surface 18)	Trunk
Arms	1:10	18 (arms $\frac{3}{4}$ of total)	Upper extremities
Forearms	1:14		
Hands	1:24	(hands $\frac{1}{4}$ of total)	
Thighs	1:4	38 (thighs $\frac{3}{6}$ of total) (legs $\frac{2}{6}$ of total) (feet $\frac{1}{6}$ of total)	Lower extremities
Legs	1:8		
Feet	1:14		

* Average of 3 cases, from areas actually measured.

† Average of 25 cases, from areas determined by means of the linear formula of Eugene du Bois; corrected to the greater seriousness of burns of the anterior surface of the trunk.

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INFECTIONS OF THE DISTAL PHALANX OF THE THUMB*

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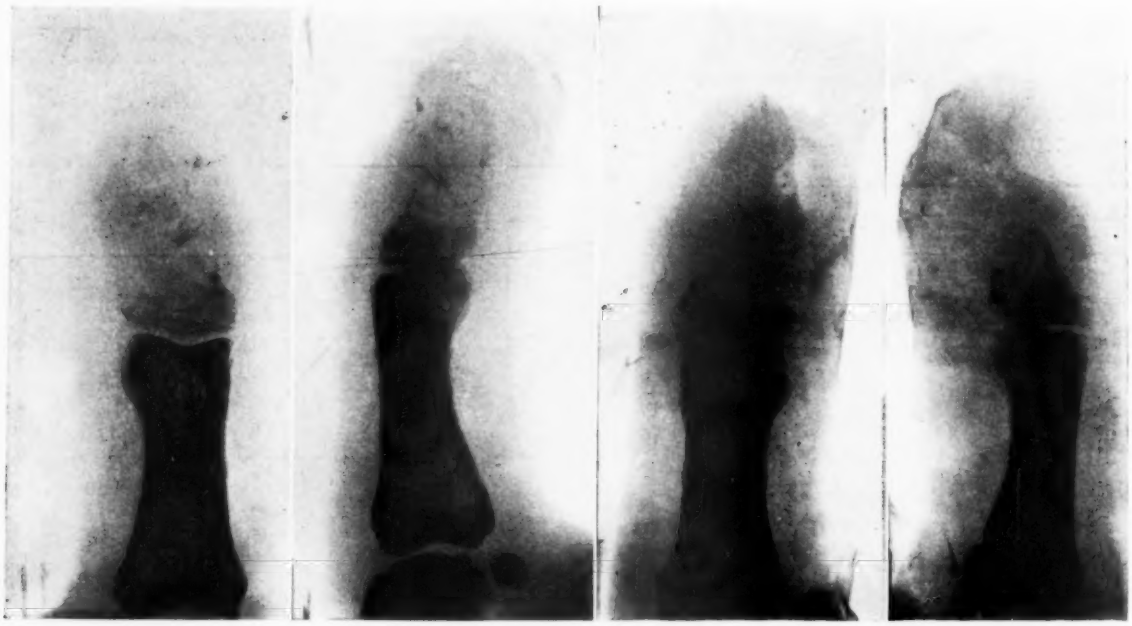
BROOKLYN, N. Y.

THOUGH but a relatively small portion of the body, the distal phalanx of the thumb if infected becomes of extreme importance. The proper management of its infections and its restoration to normal are imperative. Skilled labor or even housework is difficult without a perfectly functioning thumb. One need only try to pick up a small object such as a pin or a coin to prove this point. Then, too, the dangers of infection are not to be ignored.



A B

FIG. 1. July 1, 1928, showing advanced necrosis disseminated of diaphysis of distal phalanx; entire epiphysis is intact.

A B

FIG. 2. July 20, 1928. Areas of necrosis have been removed, leaving a well-defined epiphysis and no sequestra.

In the distal phalanx, the subcutaneous tissue consists of a number of strong fibrous septa which radiate from the periosteum to the skin. In the compartments between the septa is fatty tissue. The distal four-fifths of the phalanx are a closed space, and together with the diaphysis receives its blood supply from two digital arteries which are found on the anterolateral aspects of the bone. The epiphysis is supplied by the digital arteries before they enter the closed space. If, therefore, inflammatory exudate occurs therein, it cannot escape at all freely, so that when tension obstructs the blood supply, necrosis of the diaphysis is caused. Even after union of the epiphysis and diaphysis, necrosis is generally limited to the diaphyseal region, the base remaining intact except in late, neglected cases.

Such minor injuries frequently cause amputation of fingers for gangrene because of neglect or mishandling. Permanently crippled thumbs might have been saved with a better knowledge of the destructive action of antiseptics, instead of using fomentations and unnecessary squeezing. Infection of the distal phalanx of the thumb may be classified as: (1) subcuticular, (2) subcutaneous, (3) subperiostal. The

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A B

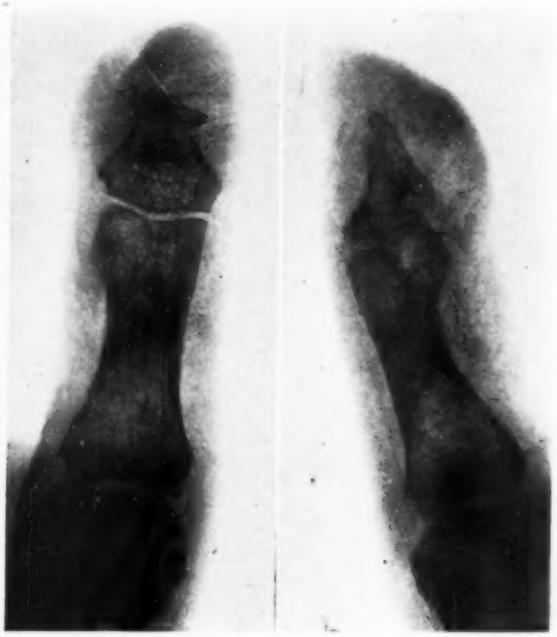
FIG. 3. July 17, 1928, beginning bone restoration and decrease in swelling of soft parts.

A B

FIG. 4. August 10, 1928, taken five weeks after Fig. 1 shows marked advancement in restoration, phalanx being two-thirds completed. Soft part swelling has disappeared and osteoporosis is present in both distal and proximal phalanx.

A B

FIG. 5. September 18, 1928, three-fourths of distal phalanx restored. The thinning out of bone shadow is due to osteoporosis and not to any extension of bone infection.



A B

FIG. 6. Dec. 4, 1928, disappearance of osteoporosis and nearly complete phalanx formed.

first and second only will be considered here.

1. *Subcuticular-purulent* blister generally results from pricking of finger or infection following a careless manicure. A collection of pus raises the epidermis from the dermis.

A B

Fig. 7. Beginning restoration of the distal phalanx after severe necrosis.

space. If present, it must be freely incised. A troublesome form of subcuticular infection is that affecting the nail fold, known as paronychia. A subcuticular abscess may form under the nail fold which may need incision, raising of cuticle. More chronic and more difficult to treat is a condition in which the nail fold becomes thickened and a small amount of pus occasionally exudes from beneath. It usually burrows under nail, between nail and matrix. Exuberant growth soon forms around nail and separates it from its bed.

In early cases it suffices to pack gauze and rubber tissue between nail fold and nail. More chronic cases necessitate parallel incision on each side of nail bed; nail fold is lifted up and nail bed cut away from matrix. Drain is inserted between matrix and flap and hot magnesium sulphate dressing applied. This type rarely involves bone. If a middle longitudinal incision is made, the new nail may be permanently split longitudinally.

A B

Fig. 8. Severe type of necrosis of distal phalanx. The small piece of epiphysis remaining was sufficient for fully restored phalanx.

A B

Fig. 9. Necrosis of upper and inner part of distal phalanx which shows retardation of necrosis due to proper incision and relieving of pressure in closed space.

Treatment: Dead skin removed with a scissors and exposed area carefully examined for a small opening through which pus may be escaping from the subcutaneous

11. *Subcutaneous:* This is a cellulitis of

finger which usually goes on to suppuration, the results from punctured wounds, with redness, heat, swelling, pain, and loss of function. Pain becomes worse and throbbing in character. Pus may be present long before fluctuation is perceived. This type occurring in terminal phalanx of thumb deserves careful consideration as the closed space is involved and necrosis of bone may occur in forty-eight hours, and then pain is relieved. Osteitis is usually a complication of subcutaneous whitlow. It occurs frequently in terminal phalanx of thumb because of its anatomy. Occasionally it may be of a hematogenous source.

Treatment: All except subcuticular infection not affecting nail fold require general anesthesia, gas oxygen preferably. A tourniquet should not be used as it lowers the resistance of the parts and favors spread of infection. A horseshoe-shaped incision parallel to nail and about ⅛ in. anterior to it is made. It has much advantage over anterior incisions because scar is remote from site of pressure. Tension is relieved in closed compartment of finger. Sloughing tissue should be removed. Condition of the bone is noted. If part of bone is loose, it should be removed. Rubber drain is inserted and daily dressings of wet magnesium sulphate applied.

A B

Fig. 10. Necrosis of distal phalanx with diaphysis remaining as sequestra. Many times diaphysis becomes dislocated. Removal of diaphysis in these cases hastens restoration of phalanx.

A B

Fig. 11. Mild case of osteitis secondary to soft part infection, which clears up with no need for curetting of bone.

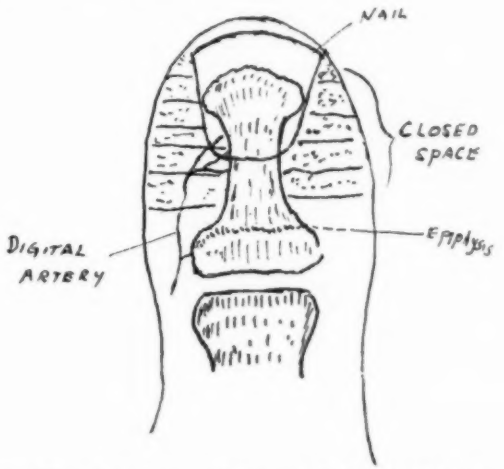


Fig. 12. Closed and opened spaces of thumb with arterial supply.

In complications, subcuticular, if paronychia is present, nail may be lost. Necrosis of diaphysis frequently follows.

Necrosis of the phalanx may be secondary to any subcutaneous infection, and as

heretofore stated, the greater part of the terminal phalanx is a closed space, so that when inflammation occurs, exudation results, and tension leads to further exudation. This, in turn, leads to further pressure on the veins. Finally vascular thrombosis results, followed by ncerosis of the diaphysis of the terminal phalanx, the base commonly escaping owing to the origin of its blood supply from without the closed space. Necrosis or osteitis of the phalanx, after a few days show in the roentogengram according to the type and severity of the infection. The osteitis may involve the tip of the bone or the entire diaphysis, and may be classified in two types for discussion, i.e., mild and advanced.

The mild type generally attacks the upper third and tip of the phalanx in some instances leaving a small sequestra. With proper incision and removal of any sequestra, these cases go on to recovery with complete restoration of phalanx.

The more severe type attacks the entire phalanx. As the epiphysis is at the lower fifth of the phalanx and outside of the enclosed sac, it does not bear the brunt of the vascular thrombosis. A line of demarcation forms at the junction of the diaphysis and epiphysis. As the infection progresses, the diaphysis becomes detached from the epiphysis, altering the size, contour, and position, becoming separated into many small fragments, and acting as a sequestra. With proper drainage and removal of the sequestra, the entire phalanx undergoes restoration, a complete phalanx being formed after several months. In severe infections, part of the epiphysis becomes dissolved, but so long as a small part of it remains, restoration will go on.

Bearse's method is to make an inverted U-shaped incision around end of finger. After flaps are separated, all of the necrotic bone is removed. To facilitate draining gauze packing is placed between the flaps. Packing is changed every other day until drainage becomes scanty. The flaps being placed in opposition without suturing are so retained until thumb is healed.

The accompanying *x*-rays illustrate the restoration of a phalanx after a marked necrosis. The case is only one of many:

Mr. Z. came to my office July 13, 1928, for treatment of an infection of his left thumb, which was of two weeks' duration, having been treated by a colleague who made an incision for drainage. *X*-ray examination (Fig. 1) revealed an advanced necrosis, disseminated, of the distal phalanx. The necrosis involved most of the diaphysis, a small part remaining intact with the epiphysis. Following the *x*-ray examination, a horseshoe incision was made and all small sequestra removed and wound drained.

Figure 2, July 20, 1928. Shows an absence of the numerous small sequestra and beginning bone restoration.

Figure 3, July 27, 1928. Shows an advancement in bone reparation and no evidence of sequestra.

Figure 4, August 10, 1928. Shows two-thirds of a well-formed phalanx, growing from the epiphysis upward towards the tip. Restoration had not progressed completely to give the rounded contour to the tip.

Figure 5, September 8, 1928. Shows progessive bone reparation. Due to the noncomplete usage of the infected thumb, a condition of osteoporosis has developed in both the distal and proximal phalanx, giving an appearance of rarefaction which wrongly is mistaken for an extension of the infection. Strict caution should be instituted before a final decision.

Figure 6, December 4, 1928, less than six months since the first roentgenogram, shows the phalanx nearly complete and an improvement in the osteoporosis due to the usage of the now nearly fully recuperated thumb. Further plates were not taken, due to the lack of cooperation of the patient.

SUMMARY

Infection of the distal phalanx undergoing necrosis with complete destruction of the diaphysis and even as much as seven-eighths of the epiphysis involved, will have a tendency to go on to complete bone restoration of the phalanx, if suitable drainage is instituted and sequestra removed.

The removal of sequestra hastens restoration; the non-removal will cause delay in waiting for them to be discharged from the wound, and may destroy neighboring healthy tissue.

The diaphysis bears the brunt of the necrosis, being within the upper four-fifths of the phalanx (closed space) while the epiphysis which is in the lower one-fifth does not, being outside the closed space.

A horseshoe incision at tip of finger not extending below the upper four-fifths of the phalanx is the incision of choice.

Necrosis in a mild case does not necessarily call for curretting for improvement.

While the receding of the flaps made by the horseshoe shaped incision may dwarf the growth of the phalanx, sufficient packing will prohibit this.

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A SIMPLE SURGICAL METHOD FOR THE ESTHETIC CORRECTION OF PENDULOUS BREASTS*

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IN the past, a number of methods have been propounded for the correction of pendulous breasts. Yet those who sought to secure the cosmetic effect endangered the function of the glandular and galactophorous elements, while the group who were intent upon reducing the size, not only involved the breast tissue proper but left unsightly scars.

The true pendulous breast is one in which the glandular, galactophorous and fatty elements are suspended in the lower pole, like a soggy sponge in a large thin bag. In this type we can easily grasp, between the thumb and the index finger, the anterior and posterior skin layers and approximate them. The pendulosity usually varies with the amount of attention and care it receives. In the patient I treated it extended down to the umbilicus, the nipple being 12 in. from the midclavicular region. This she had acquired by continually pulling the breasts down, in order to obtain the questionable form of the masculine. For this type, it sometimes becomes an economical problem, especially so if the women are models or dancers. It is for them that a truly cosmetic and corrective measure must be obtained. If, to these prerequisites, we can eliminate morbidity, avoid any possible interference with function, immediate or future, and allow the women to go on with their work even if moderate, I feel we have attained as near the ideal operation as is possible.

If we can realize that the size and amount of fat deposited in the breasts are dependent upon the general metabolic state of the individual, we soon see that we cannot give to a woman who weighs 250 lb. breasts of a Folies Bergere, nor to a small puny one, those of a Venus de Milo. But in a selected patient with an otherwise well proportioned body, a great deal can be done toward the restoration of the normal form without extensive resection of the gland tissue.

Joseph, Passot, Frist, using Lexer's method; Glaesmer, Axhausen, Lotsch, all either resect part of the breast or transpose the nipple into a newly made bed, or do both. The risks of necrosis, infection, sloughing of the nipple or even possible gangrene due to tortion of the vessels and ducts are too great to classify these among the operations of choice. DeQuervain simply resects the breast from its submammary fold and attaches it to a higher level on the pectoralis fascia. Noel and Lopez-Martinez remove crescentic shaped pieces of skin above the areola, this being done in two or three stages, each time bringing the scar closer to the areola. The cosmetic effect is excellent.

Adopting the principle of Lopez-Martinez to a certain extent, I have devised a method which I believe fulfills all the necessary requisites. With the patient in the erect posture, and completely relaxed, I measure the length of the breast, using a line drawn from the midclavicular point down to the nipple. The breast is then raised to the preferred height, and the distance is again measured. The difference between the two is the approximate amount of elevation desired. With an applicator dipped in methylene blue, a crescentic shaped area, half the size or perhaps a little more than half of the amount of elevation to be obtained is marked off. The concavity of the crescent faces the areola. A similar area is likewise mapped on the under surface. With a sharp scalpel the upper markings are retraced. The methylene blue is then removed with alcohol. The skin is carefully bisected until the glistening

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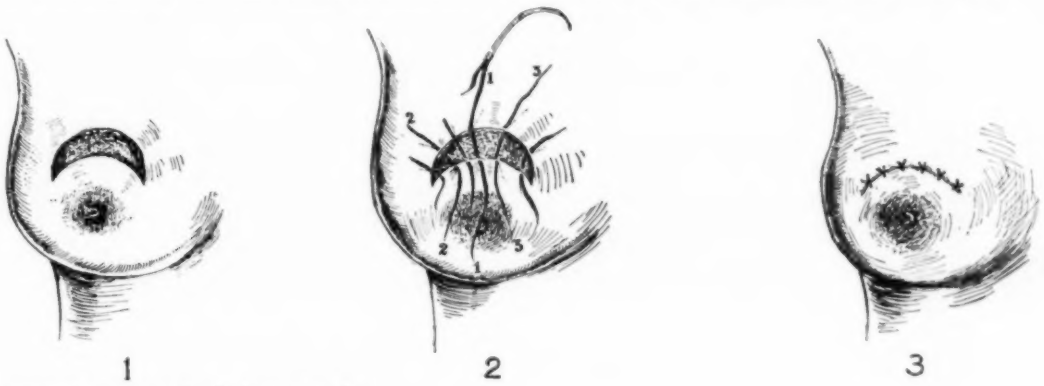
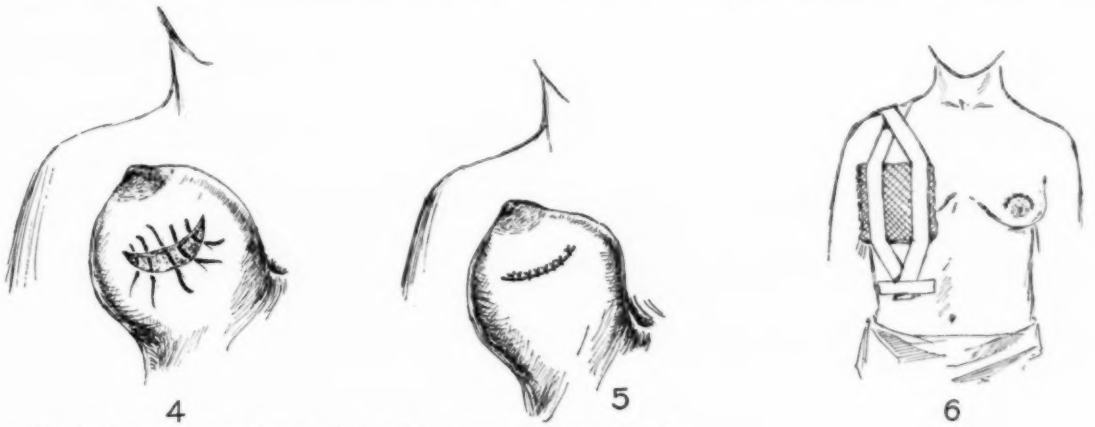
fascia immediately above the fatty and glandular elements comes into view. Up to this time practically no bleeding is encountered. Gently the fascia is cut. As this is done the fat and breast tissue pops through the nicked area. This is proceeded with until the entire skin flap is removed (Fig. 1). If done very carefully the field is almost entirely dry throughout the procedure. The edges of the wound are approximated with chromic gut 0, placing the first suture in the center and the next two so that each of the newly created sectors are again bisected (Fig. 2). This avoids puckering. The sutures are threaded on a straight surgical needle. Each stitch includes the skin and fascia only, care being taken to avoid the fatty tissue. The under surface of the breast is treated similarly. The assistant then holds the breast upward and inward. A 3 in. wide adhesive strap is placed below the breast on the abdominal wall, and then drawn tightly upward and over the outer border of the breast, across the corresponding shoulder to the back. In the same fashion another strap is placed on the sternal border. This makes a fairly snug support. The patient can wear ordinary street clothes, with very little, if any, dressing showing. She is allowed up and out of bed the following day and in another may assume her daily routine (see Figs. 3–6).



1 2 3

Fig. 1. Crescentic area excised above areola.
Fig. 2. First suture is placed in center of excised flap. Sutures 2 and 3 are placed equidistant on either side of suture 1.
Fig. 3. Scar above the areola at end of primary operation.



4 5 6

Fig. 4. Excised area on under surface with some of sutures in place.
Fig. 5. Closed wound on under surface at end of primary operation.
Fig. 6. Application of adhesive straps are so placed as to allow wearing of usual clothing with minimum exposure of dressings.

In ten days the dressing is removed. Some of the sutures are simply brushed off, the others are removed. Two things

become immediately apparent. The breasts are definitely higher, from 2 to 3 in., and as a result of the tight dressing there is a redundancy of skin at the sternal margin of the mammae. At least, there has been no new deposition of fat and perhaps some of the old has been consumed by the general metabolism of the body. Evidently the redundancy in this region is due to the natural tendency of the breasts to turn outward, in the relaxed condition. During the ensuing month the wounds are covered with as little dressing as is commensurate with safety. They are permitted to hang freely. Thus ends step one.

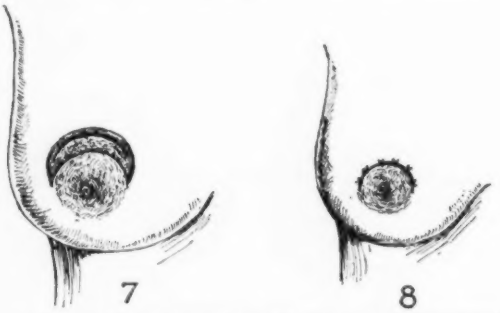


Fig. 7. Secondary operation. New crescent so made as to include primary scar in upper arc, and upper border of areola in lower arc.
Fig. 8. Relation of new scar to areola.

We now proceed with the last half of the operation. Again a crescentic area is marked off above the areola. This time the upper arc is just above the old scar, while the lower arc is at the border of the areola. This flap is treated as in the first instance. A little more bleeding is encountered. This is carefully checked. The new suture line is in or at the areolo-cutaneous junction (Figs. 7 and 8).

The breast is turned upward. With methylene blue an arc is drawn immediately in front of the old scar. Another arc which begins just inside the sternal border of the breast and 1¼ in. above the submammary fold is then so made that its outer end converges to meet the outer end of the upper one. The inner side being now returned to, the open ends of the arcs are joined by a v-shaped line, the point of the v being directed toward the united ends of the arcs. The size of the v depends upon the amount of redundant tissue in this area. The outlined flap as it now appears looks like the letter m lying on one side with the lower end sealed. The concavities of the arcs must always be towards the nipple. The part thus enclosed is excised (see Fig. 9). The v is then drawn downward and outward. The extent of traction is guaged by the amount of puckering. The lower end of the v is sewn to the lower arc, while the upper arc is approximated to both the upper part of the v and the remainder of the lower arc

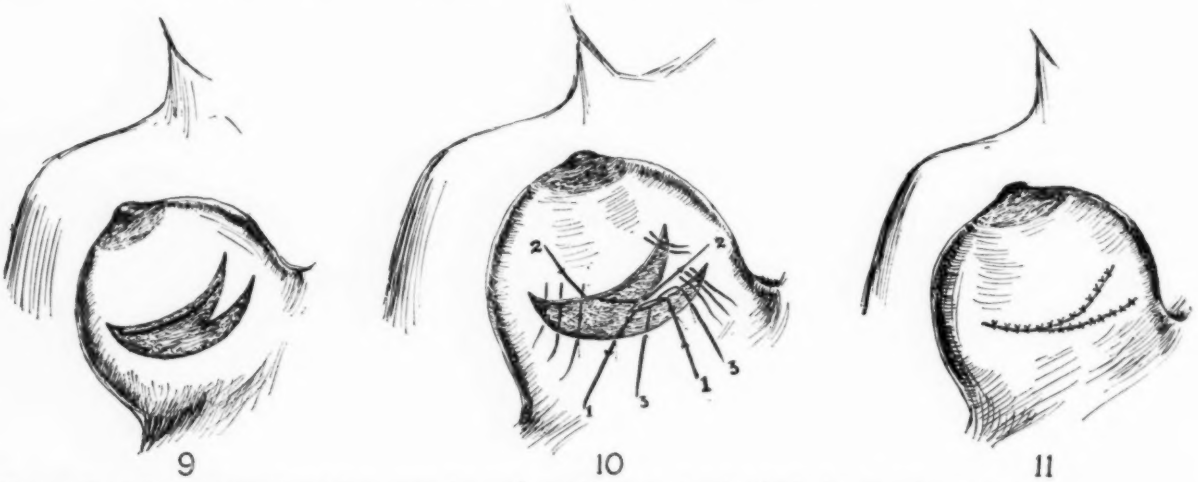


Fig. 9. Reclining m-shaped excision on under surface of breast, showing inclusion of primary scar.
Fig. 10. Placing of suture No. 1 depends upon amount of puckering of skin at mesial border of breast.
Fig. 11. Appearance of scar on under surface of breast at conclusion of secondary operation.

(see Fig. 10). The reclining M has been converted to a reclining Y (Fig. 11). The breast has now been raised an additional 2 or 3 in. The upper scar is masked by the pigmented areola, the lower by the breast itself. The dressings are of the same type as in the first part.

There has been no resection of breast tissue. The circulation and nerve supply of the areola and the nipple are not interfered with. The galactophorous ducts are not disturbed by any transplantation of the nipple. The dangers of infection and fat necrosis are minimal. The visible cosmetic effect is that of a normal breast. The patient need no longer resort to specially constructed brassieres. She can wear a low cut garment with perfect safety.

It might be interesting to add that the menstrual periods of the patient upon whom I performed this operation, following it, were of the normal twenty-eight day interval with no pain, while for a long time previous the periods were at twenty-one day intervals with hypogastric pains which were becoming progressively worse.

In conclusion, for the uncomplicated pendulous breasts, this procedure is one of choice, because;

1. It is simple in execution
2. There is no distortion or destruction of vital tissue
3. The cosmetic result approximates the normal
4. The dangers of infection and interference with lactation are minimized
5. There is no economic loss of time
6. The end-results are gratifying to all concerned.

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THE ETIOLOGY OF ANAL CANCER*

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THE incidence of malignancy of the anal canal has been variously estimated at less than 1 to greater than 10 per cent of all rectal cancers. This variation arises largely from differing conceptions of the anal limits: the lower figures are found where only the skin-covered orifice is included, the higher where the anatomical description is followed. Gray[1] defines the pars analis recti as beginning at the level of the apex of the prostate and ending at the orifice, a geographic division necessarily followed in this discussion as the canal so described is that portion which (1) forms an angle with the lower rectum (2) is narrowed by the sphincters and levatores and (3) is the site of anal pathology.

Thirteen cases of malignancy originating in the anal canal have occurred in my own series of rectal cancers, and a study of the histories obtained and of the tissue findings in these cases forms the basis of this contribution.

The chronic irritation theory has been generally adopted in connection with the origin of malignancy. The *Journal of the American Medical Association*[2] for example said editorially recently, "The trend of results of recent cancer research here summarized is in support of the old view that cancer is usually the result of protracted stimulation of the growth of tissue by non-specific agents," and *Surgery, Gynecology and Obstetrics*[3] in August declared editorially (through W. J. Mayo), "Cancer never develops in sound tissues." Ewing, in a lay publication in 1927 stated, "It is a fortunate fact that most cancers are preceded by various forms of chronic irritation many of which we can detect and thus prevent cancer. Since about 1860 cancer has become recognized more and more as the result of chronic irritation."

The application of this theory to rectal cancer exclusive of the anal canal has also been generally accepted in connection with preexisting adenomas, (Yeomans[4] and many others) and chronic colitis (Bargen[5] and others).

If it is true that unsound tissues in the anal canal, resulting from the long-continued existence of various forms of common anal pathology with infection and irritation, have the same provocative reaction in susceptible subjects as do similar tissues in other parts of the body, it becomes an unfortunate fact that the weight of written authority has up to this time discouraged the very logical resulting conclusion. Ewing[6] (who seems to base his statement largely on an expression from Kraske some years ago) has been widely quoted to the effect that a tissue predisposition appears definitely only in those cases arising on multiple polyposis, that there is no satisfactory evidence that cancer develops in tissue altered by hemorrhoids, fistulae, or cicatrices and that in the 38 per cent of cancers of the pars perinealis reported by Zinner[7] to complain of hemorrhoids, the latter were uniformly the result rather than the cause of the malignancy. Pennington[8] rejected the entire irritation theory and believed hemorrhoids when present were a mere coincidence. Lockhart-Mummery[9] ardently supports the adenomata theory in the rectum, grants the occasional occurrence of cancer in fistulous tracts but doubts the etiological significance of other benign anal pathology.

At the onset it is essential clearly to define our premises, which has not been done in much of the literature on this subject. It cannot logically be contended that lesions in the anal canal influence the development of malignancy in the ampulla

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Read before the A. M. A. Section on Gastro-Enterology and Proctology, Detroit, June 25, 1930.

or at the rectosigmoid junction; here the double lesion is clearly purely coincidence. Nor is it my contention that anal cancer necessarily develops *directly* from the prior benign lesion; polyp formation may and no doubt does play a part in the origin of cancer of the upper portion of the anal canal, where glands are present and where adenocarcinoma may develop, but the inflammatory or irritative origin of adenomas is generally conceded and the possibility that the adenoma is secondary to an old anal lesion remains.

A review of the literature since 1915 reveals that 18 specific instances in which malignancy has developed in benign anal lesions have been reported by ten observers, in addition to a number of vague references to cases observed by others. The preceding lesion is given as piles in 7 instances (Hirschman and Rosenblatt,[10] Yeomans,[11] Plisson[12] Howe and[13] Gibbes[8]). Sarcoma resulted in 1 case, epithelioma in 2, colloid carcinoma in 2, and adenocarcinoma in 2. In 4 cases the length of the hemorrhoid history was mentioned: fifteen years, seventeen years, twenty years, "a long time."

Seven fistulae resulting in cancer have been reported (Moon,[14] Yeomans,[11] Fitchet,[15] David,[16] Pennington[8]), two adenocarcinomas, one colloid carcinoma, two epitheliomas, one basal cell cancer, one not stated. The fistula had been present, when stated, "more than two years," six years, ten years, twenty years.

Three cases of pavement-celled epithelioma from leucoplakia have been reported by Brofeldt[17] and 1 case of epithelioma in an imperforate rectum (McCray[18]).

In my own opinion this group of cases is a tremendously inadequate representation of the true picture and it is suggested that two factors are responsible.

Such a logical sequence is not thought worthy of special record by the casual observer; or in instances where cancer has overgrown the original benign lesion the significance of past symptoms is overshadowed by the present tragedy of malignancy.

My own cases may be briefly summarized as follows:

Case 1. L. B., a white woman of sixty-one

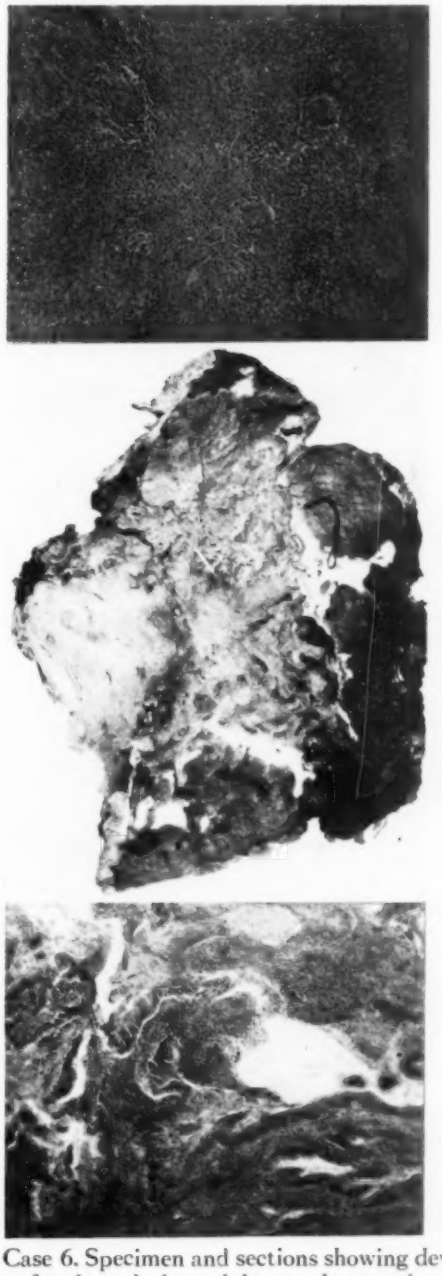

Fig. 1. Case 6. Specimen and sections showing development of tuberculosis and later adenocarcinoma in old fistula.

was operated upon in 1922 for a fistula of three years' duration and an anal polyp found near the internal opening. One year later the polyp was found to have recurred, the tissue being adenocarcinoma. Path. (#23–1431 Baylor.)

Case 11. T. E. J., a white grocer of fifty, with a history of hemorrhoids and fistula

for six years was found to have a small warty growth at the outlet of two fistulous tracts. Each growth was made up of squamous celled

Fig. 2. Case 8. Squamous cell cancer arising in piles with ten year symptoms.

carcinoma. (City County Rectal Service, Path. #26–215.)

Case III. E. L., a Mexican male of fifty, with a fistula history lasting ten years, was found to have a large friable mass involving all the tracts, which was clinically adenocarcinoma. No lesion was found above the anorectal line.

Case IV. V. H., a negro woman of fifty had a history of fistula for fifteen years. A dense mass was present about the single fistulous tract and a small elevated ulcer was seen at the outlet. The ulcer was found to contain adenocarcinoma and the entire tract was lined with the same tissue. The dense mass was fibrous tissue infiltrated with cancer. Although the process was believed to originate at the internal opening at the anorectal line, no definate lesion could be made out above this point. (Path. #27–1786 Baylor.)

Case V. E. J., a negro female of fifty in the Rectal Service at the City County Hospital, gave the history of fistula for one year. Grossly there was no suggestion of malignancy, but tissue removed showed microscopically areas of adenocarcinoma and a few months later, resection not being done, the wound was a mass of friable adenocarcinomatous material. (Path. #28–215 and #28–584.)

Case VI. M. C. T., a negro male of fifty-seven, had a history of persistent fistula for fifteen years. A number of sections were made on 1–22–29 which demonstrated poorly defined nodular areas in which were seen Langhans' giant cells. Tissue removed three months later was found to contain adenocarcinoma in addition to the tuberculous inflammation. (Path. #29–106 and #29–641. Fig. 1. Baylor.)

Case VII. J. B., a negro male of sixty, developed a fistula one year before admission to the Rectal Service at Baylor Hospital. Six months before admission, his symptoms were complicated by the addition of hemorrhage, anal pain and constipation. Examination revealed an annular gelatinous adenocarcinoma above and in contact with the anorectal line which was invading the fistulous tract. (Path. #30–479.) Considerable doubt exists here as to the priority in time of the fistula, but taken in conjunction with the other cases, the history is suggestive.

Seven cases are reported in which fistula had been present before the discovery of anal cancer, for fifteen years, (2 cases) ten years, six years, three years, and one year (2 cases). One patient had been operated on a year previously for fistula and an adjacent anal polyp removed, the latter showing recurrent adenocarcinoma upon admission to Baylor. Another had small warty growths at the external openings which contained squamous celled cancer. In five others adenocarcinoma was found invading fistulous tracts, apparently originating at internal openings but (Except in Case VII) without tumor formation at this point. Of these 5, 4 were negroes which is interesting in view of the comparative rarity of rectal cancer in the negro.

Case VIII. M. W., a white school teacher of fifty-five had a history of passing bright red blood after stool, together with protrusion of pile masses for ten years. Examination revealed large hemorrhoids, a hypertrophied anal papilla, and in one internal-external pile a firm mass the size of a pigeon's egg. Pathological report on mass (#23–909, Baylor) "firm grayish red tissue with skin attached showing many cells invading tissue in all directions. Some mitotic figures. Epidermoid cancer, squamous cell type" (Fig. 2).

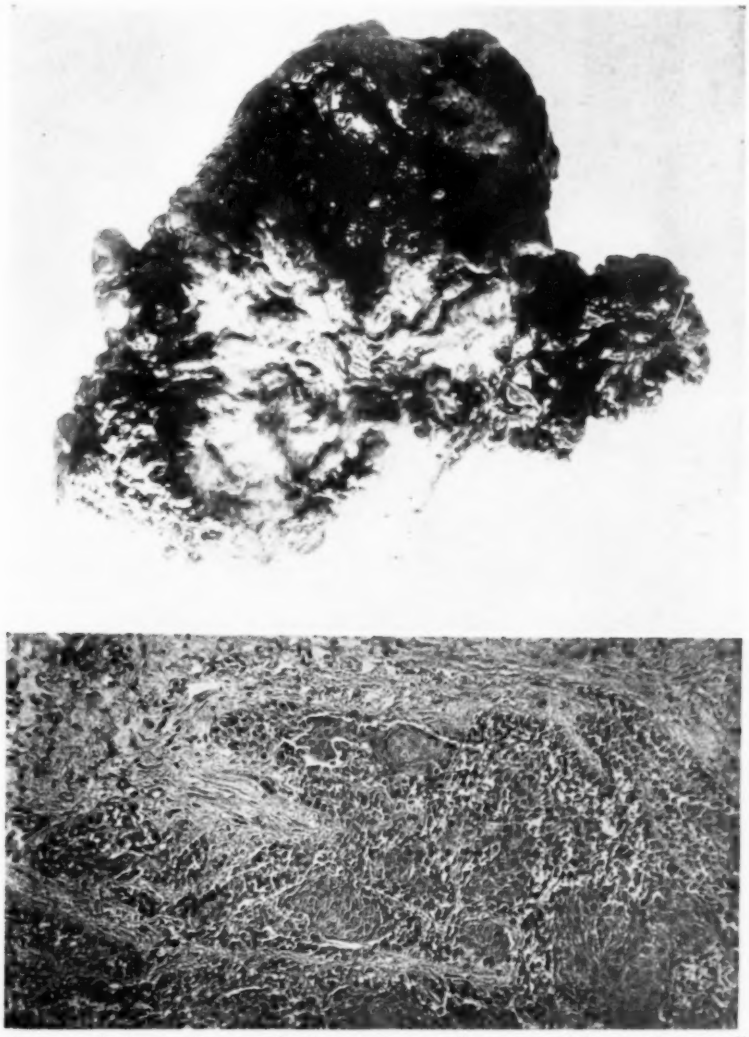

Fig. 3. Case 9. Specimen and photomicrograph of squamous cell cancer arising at dentate line in ancient piles.

Case IX. E. M. W., a white housewife of fifty stated that she had experienced intermittent bleeding and protrusion of piles for twenty years. Three weeks before admission her symptoms were complicated by the addition of excruciating anal pain. Examination disclosed large internal hemorrhoids and an indurated anal ulcer lying between two piles, above and impinging on the dentate line. The pathological diagnosis was squamous cell carcinoma (#24–302 Baylor Rectal Service) (Fig. 3).

Case X. F. M., a white woman of seventy-seven reported that she had suffered with protruding piles for thirty years. Ten months before she came to my office her hemorrhoids ceased to protrude but pain and passage of blood-stained pus began. Examination disclosed an indurated anal tumor which was (clinically) epithelioma with extension to the inguinal glands.

Case XI. J. O. M., a white housewife of fifty-six reported that for eleven years she had noticed bleeding and protruding piles.

Some months before entering Baylor Hospital protrusion had gradually ceased to occur and anal pain and discharge had developed.

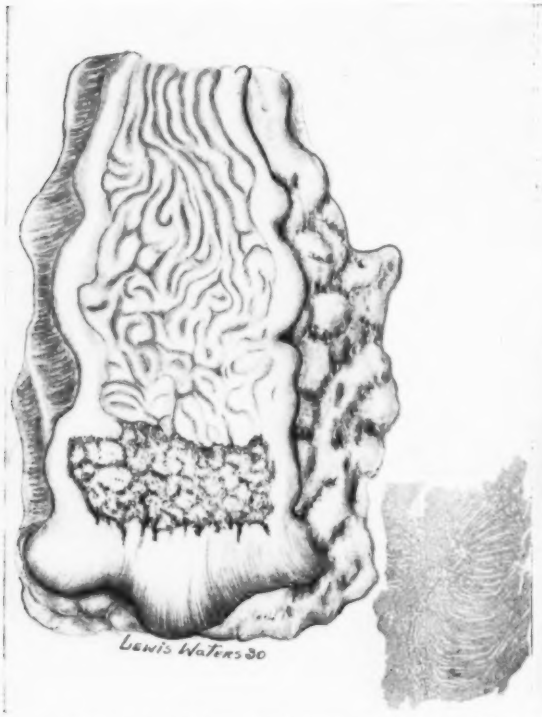

Fig. 4. Case 11. Adenocarcinoma replacing piles of eleven years' duration.

Fig. 5. Case 12. Adenocarcinoma developing in presence of chronic cryptitis and papillitis.

Examination disclosed an annular ulcer occupying the exact limits of the internal hemorrhoidal zone above the dentate line, which was microscopically adenocarcinoma (Fig. 4).

Four cases were seen giving a history of bleeding and protruding hemorrhoids for periods varying from ten to thirty years. In one a squamous celled malignant ulcer was found lying between two ancient piles and extending upward from its origin at the anorectal (dentate) line, in another a firm mass the size of a pigeon's egg lying in a prolapsing interno-external hemorrhoid was found to contain epithelial cancer, in the other 2 cases the hemorrhoids had been completely replaced by malignant tissue, adenocarcinoma in Case xi and epithelioma in Case x.

Case xii. H. L. B., a white woman, aged sixty-five entered Baylor with the complaint of anal bleeding and pain for eight months. Before that time she had noted only mild irritation for a period of years. An adenocarcinomatous anal ulcer (Path. #29–1602) was present, impinging on the dentate line which showed marked chronic cryptitis and papillitis (Fig. 5).

Case xiii. C. G., a Mexican woman of sixty-five was admitted to the Baylor Rectal Service with a large protruding anal mass present for several years. The patient spoke no English, and the history obtained through an interpreter failed to reveal any definite story of prior anal pathology. The mass was found to be a Grade 3 adenocarcinoma.

In 1 case the gross specimen revealed the presence of chronic cryptitis and papillitis, in another no prior history of anal disorder was obtained.

In the entire group there were 4 males and 9 females; 7 Caucasians, 4 negroes, and 2 Mexicans. The average age of the group was 57.3 years; none were under fifty.

I have seen no cases arising from pruritis, although Brofeldt[17] has reported 3 arising on leucoplakic epithelium. In view of the present opinion that 40 per cent of primary

epitheliomas of the vulva originate from vulvar pruritis,[19] one would expect a greater reported incidence of anal cancer from this lesion. I recently removed a perianal papilloma arising on pruritic skin in a male of fifty-four who had itched for twenty years.

The records of Baylor Hospital reveal 2 additional anal cancers occurring as a consequence of benign pathology. One was a male of forty-eight whose anal fissure was the site of an epithelioma after three operative procedures during a period of six years had failed to cure the ulcer. In another an inflamed anal tag was the site of cancer with metastasis to the inguinal glands.

SUMMARY AND CONCLUSIONS

1. A series of 13 cases of anal cancer occurring in the writer's own rectal services, are reviewed. In 12 of these benign anal pathology is believed to have been present before onset of malignancy and to have brought about a local tissue predisposition.

2. In addition 18 such cases from the literature and 2 from other services at Baylor Hospital are reviewed.

3. It is suggested that a more general investigation of the prior history and local findings will multiply the number of similar reports.

4. Admitting the possibility of coincidence in some cases, it is believed that there is satisfactory evidence that anal cancer may develop in tissue altered by hemorrhoids, fistulae or cicatrices.

The author is indebted to Mr. Lewis E. Waters of the Department of Anatomy, Baylor Medical College, for drawings and photomicrography.

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PROSTATIC ABSCESS:

A CLINICAL STUDY OF 42 CASES*

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IF one were to judge, either from its treatment in the common texts or from its management in ordinary surgical practice, one could not avoid the conclusion that, commonplace as it may seem to be, there still remains plenty of opportunity for further consideration of the whole subject of abscess of the prostate and for more complete accord in the matter of its diagnosis and its treatment. As a basis for this presentation, a detailed study has been made of 42 cases of proved, frank abscess of the prostate.

ETIOLOGY

In considering the etiology of prostatic abscess, one is, of course, at once struck with its association with gonorrhea. This is especially true because of the large number of patients who, at the peak of a posterior gonorrhea, have such a violent associated prostatitis that only days of careful observation will permit the exclusion of true prostatic abscess. In spite of the prominent part gonorrhea has to play in its etiology, however, abscess of the prostate can and does occur entirely independently of gonorrhea. One-fourth of the cases in this series had neither history nor evidence of recent or active gonorrhea. In at least 4 of these patients, not only had there never been a gonorrhea but there was a very definite clinical picture of metastasis from infection elsewhere. These cases seem worth reciting. One case developed two weeks after the onset of an extensive furunculosis. A second occurred at the height of an attack of acute rheumatic fever. A third followed promptly upon some dental surgery for a foul, chronic gingivitis. Yet another occurred one week after the lancing of an acute abscess formed at the site of a chronic osteomyelitis of years' duration. One patient in this series had a staphylococci abscess superimposed upon a proved prostatic cancer, certainly not a venereal abscess. In still 5 other cases there was nothing in the history or findings even suggesting gonorrhea as an etiological factor.

DIAGNOSIS

It has already been stated that a frank, fully developed abscess was proved in each of our 42 cases. When this is considered, together with the fact that our records show no other patient on whom prostatotomy was done, it must be evident that we have erred on the side of non-intervention when abscess was in question. This is made more evident by the number of instances in this series in which operation was done a week or two after the possibility of abscess was first considered; in one instance after ten days of complete retention.

Three of our patients ruptured into the urethra spontaneously, and a fourth was unintentionally ruptured on a Kollman dilator. Of the three fatalities, one died of ileus the fourth day after suprapubic rupture with the finger in a effort to enucleate what was thought to be a benign hypertrophy but at necropsy proved an abscess within a cancerous gland; a second died on the table, being moribund with peritonitis when first seen. The third was particularly interesting in that it presented a classical picture of fulminating appendicitis. Appendectomy was promptly done and autopsy the following day disclosed a pelvic phlegmon emanating from a prostatic abscess.

It seems no apology need be offered for these fatalities, at least from the standpoint of undue delay in diagnosis. With

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that granted, there has been nothing in our experience to dissuade us from the position that there is complete safety in the careful observation of a suspect until definite abscess formation is evident. This position is certainly strengthened by the large number of acute gonorrheics whom we all see, having frequency and dysuria, a prostate large and tender, and even some fever and urinary difficulty, and yet whose symptoms ultimately subside and disappear under judicial expectant treatment.

With the textbook picture in mind, there is somewhat of surprise in a review of the diagnostic signs and symptoms in this group of cases of frank prostatic abscess. Frequency and strangury (except, of course, in the event of retention) were a constant complaint. Although but half of these patients experienced rectal or perineal pain, it was our experience that when it was an outstanding symptom and especially when the patient, in sitting, rode the edge of the chair on his thigh, it very strongly suggested frank abscess. Only 6 of these patients complained of chilly sensations and none had a frank chill. Less than half had any fever at all before operation and only rarely did it exceed 3°. Little or no fever seems the rule in prostatic abscess. About half of these patients had complete retention; practically all noted some difficulty in voiding. Though it is far from constant, complete retention seems the most definite of all symptoms of abscess of the prostate.

It is conceivable that the recognition of fluctuation by palpation per rectum is a matter of quite variable personal ability. Certainly, when fluctuation can be felt there is nothing further to be considered, so far as diagnosis is concerned. Notes on these cases of proved abscess show that fluctuation was unquestionably felt in less than one-fourth of them. In the remainder, the prostate was felt tender, enlarged, often tense, and often extending indefinitely up onto one or both seminal vesicles or laterally onto the inner pelvic wall.

TREATMENT

A recital of some of the present day teaching regarding the surgical drainage

Fig. 1. Extensive sinus formation in prostate and seminal vesicles as seen through the symphysis bone, lipiodol urethrogram.

of prostatic abscess may prove interesting. Keyes dismisses all other methods with one sentence and then describes in detail the virtues of Stevens' method of blind puncture per urethram with the tip of a sound. Livermore and Schumann favor unilateral perineal incision and blind puncture of the abscess by plunging a hemostat up through the ischiorectal fossa. Chetwood gives about equal prominence to the method of finger rupture through external urethrotomy and the method of posterior prostatotomy through radical perineal dissection. Eisendrath and Rolnick unequivocally recommend radical perineal exposure and posterior prostatotomy. Young is, of course, also of this view. These text teachings are cited merely to show the wide difference of opinions regarding a proper surgical procedure in draining these abscesses.

In our series there were 4 cases of rupture of the abscess per urethram, 3 spontaneously and 1 on an expanded Kollman dilator. These are of some interest in considering the several methods recommended for rupture of the abscess into the posterior urethra. Of these 4 patients, one left the hospital quite well in thirty days. The other 3 were less fortunate. One has persisted with a chronic recurring gonor-

rhea for four years despite all ordinary treatment. A second lingered for three months and finally developed a large ischiorectal abscess, the drainage of which effected cure. A third is still under treatment, two years after spontaneous rupture. He eventually had an external urethrotomy done in an attempt to facilitate better drainage. A few months later he had some sort of perineal dissection in an attempt to correct his urinary fistula. He is still in the hospital, in miserable shape, and we present a lipiodol urethrogram to visualize the extent of false cavity formation that has persisted. Although these cases, per se, cannot fairly be taken as grounds for judgment for or against the Stevens' method of sound puncture, despite the favor of no less an authority than Keyes, the procedure strikes us as being entirely unsurgical and, like spontaneous rupture, altogether too likely to result in permanent false cavity formation in the posterior urethra.

Ten patients in this group were operated upon and the abscess broken into the posterior urethra with the finger inserted through a perineal urethrotomy wound. This procedure necessarily results in a perineal urinary fistula of more or less duration. The average hospital stay of these patients was fifty-two days, and even then exactly half of them were discharged from the hospital with some perineal leakage. Incidentally, one patient so operated suffered a nearly fatal secondary hemorrhage on the twelfth day. Contrast with this, the 21 patients operated by posterior prostatotomy through a completely dissected perineum. The average hospital stay was nineteen days. One had urine draining through the perineal wound for thirty-six hours after operation. A second had a fecal fistula lasting from the eighth to the eleventh day. All the patients left the hospital with wounds perfectly healed and with infinitely less residual urethritis than in the other group.

Epididymitis is naturally a frequent complication of prostatic abscess. It may be of some significance to note that of the 21 patients in whom drainage was done by posterior prostatotomy only *six* epididymi became involved, whereas *eight* epididymi became involved in the 10 cases urethrotomized. These figures are not surprising when it is considered that incision into the posterior surface of the prostatic lobes can be made without danger of injury to the ejaculatory duct, a factor of safety not present in any other recommended type of drainage.

There is much to be said in favor of some such method of drainage as that recommended by Livermore and Schumann wherein the back surface of the prostate is pierced by a hemostat burrowed up, on one side or the other, through the ischiorectal fossa. Such a procedure involves none of the risks attending the various methods of intra-urethral rupture and, in addition, escapes the difficulties of a complete perineal dissection. There seems to be but one drawback to such a method. Its use involves an accurate knowledge as to which lobe is the seat of abscess. In our experience, this has not been as simple as one would suppose. There have been occasions in which the lobe suspected as being abscessed was incised without tapping pus but a frank abscess was opened by incision into the other lobe. More than that, of the 21 patients operated on by perineal dissection, 12 had frankly bilateral abscesses, though the rectal findings rarely indicated such a situation.

There is yet another factor worth consideration in the choice of operation. The various texts seem to emphasize the point that an abscess developing to any considerable size within the prostate tends to point either into the urethra or laterally and downward into the ischiorectal fossa. These are, of course, favorite sites of extension but there have been a fairly large number of our patients in whom the abscess either was primary in the seminal vesicle or burrowed there from its original site in the prostate. In such instances, especially if at all massive, the abscess

cavity, when opened, was found to extend quite deeply into the retrovesicle region. At least in such cases, it would seem that drainage under vision would be far better and safer than any procedure done blindly and by "feel."

In conclusion we believe:

That in any acute prostatic inflammation there is complete safety in waiting until careful observation has permitted a definite diagnosis of frank abscess formation.

That both prostatic lobes should be opened, whether or not the signs indicate bilateral abscess formation.

That any method involving opening of the abscess into the posterior urethra entails unnecessary risk of persisting urethritis from false cavity formation.

That drainage through external urethrotomy unduly lengthens morbidity, favors the development of complicating epididymitis, and entails the unnecessary risk of a more or less persistent urinary fistula.

And, finally, that no method offers greater freedom from complications and sequelae or more certain cure of the disease than that of radical perineal dissection with posterior prostatotomy.

CECOPEXY AS AN ADJUNCT TO APPENDECTOMY

IN SOME OPERATIONS ON THE APPENDIX*

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CINCINNATI, O.

THE layman of today is "appendix minded" to such an extent that he is prone to interpret any right lower quadrant pain as being due to appendicitis. The use of the phrase "chronic appendix" has been severely criticized; but nevertheless, in a large percentage of cases, no other expression so satisfactorily paints for the people of today a word picture of a pathological condition that through usage, has become not only an entity in the medical mind, but has been accepted by the layman. A great forward step has been made in the psychological attitude of the public toward operations in the past decade or two; a large number of people have been converted from a state of abject fear of surgery to a frame of mind willing to accept and even ask for an operation as a means to secure relief from a disability.

In advising patients with chronic right lower quadrant pain, the motto, "When in doubt operate," has no place until all means leading to a diagnosis have first been tried. If, for no other reason than that of the dread possibility of postoperative adhesions, obstruction of the bowel or embolism, surgery should not be resorted to unless an amount of good, commensurate with the risk involved, be almost a certainty. We cannot lightly pass up the responsibility for the removal of a more or less innocent appendix, by saying, "Well, it's out, his appendix won't hurt him now, and we didn't do him any harm anyhow." In the wave of medical enthusiasm for appendectomy as a cure of right-sided distress, the surgeon was first a leader, but now is a pessimist, holding back, wishing to be "shown." The layman is still clamoring for operation, unfortunately, and it is hard to refuse this request. The greatest steadying influence, acting as a check on a too great enthusiasm, and leading to saneness of judgment, is the quiet careful consideration of the postoperative records of patients upon whom operations have been made.

The most valuable and at the same time enlightening records are the follow-up records of the cases marked as "cured" at the time of dismissal. We all know well the many factors that make the average patient, going home after a twelve or fourteen day uneventful operation convalescence in a modern hospital, feel on the top of the wave. The advantage of follow-up records is to demonstrate which of our "cured" cases have turned out to be failures at the end of a year or two, so far as relief from the preoperative symptoms is concerned.

There is, in my opinion, no more difficult problem than that concerned with the diagnosis of chronic appendicitis. If a surgeon is honest with himself, the actual findings may be at great variance with his preconceived picture of the pathological condition. The answer as to what constitutes a "chronic appendix" will vary greatly, depending upon whether the answer is from an internist, a pathologist, roentgenologist, or a surgeon. In this paper I desire to limit the use of the phrase "chronic appendicitis" to those cases in which there is no history of acute or subacute attacks, but which come to us with reasonably consistent and definite complaints of right lower quadrant pain, soreness, distress or discomfort, perhaps some indigestion, borborygmi, eructations of gas or sour fluid, constipation, and physical findings of tenderness in the general region of the appendix. The diagnostician has had all the various special examinations made but these are either negative or inconclusive. The roentgenologist is apt to have reported that the

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appendix "did not visualize on successive days' examination and during the fluoroscopic examination the region of the head of the cecum was tender on deep pressure and movable, with no evidence of adhesions." His conclusion often reads, "suggestive of chronic appendicitis due to its failure to visualize and because of tenderness in the region of the cecal head." In these very types of cases, too many times on the operating table one finds an appendix, the best excuse for whose removal is, that when removed it can no longer cause appendicitis. We have not yet reached that stage of perfection in abdominal, surgical or anesthetic technique where prophylactic operations are justifiable in the absence of pathological findings. The average time lost from the chronic appendicitis operation is about six weeks. This alone, as an economic factor, must be reckoned with.

Before going into the real subject matter of this paper, let me unmistakably express my opposition to the general principle of most ptosis operations, that is, the various types of operations that seek to rearrange the internal draping of the abdominal contents. This is a field that the abdominal surgeon investigated and discarded some years ago except in the very unusual condition and case. Many good procedures, however, that have been discarded, because an over-enthusiastic application of a principle swung the pendulum to an absurd position, we have later reclaimed and applied successfully in properly selected cases. Recently fixation of the kidney has reestablished itself for the correction of the case of ureteral kinking due to prolapse so that in nephropexy we have an operation that passed through the three periods of, "the latest fad," "in the discard," and "a present sane revival."

It is not my desire to call attention to the long list of surgical, gynecological, genitourinary, neurological and orthopedic diseases that need to be differentiated from appendicitis, or the ways and means to differentiate them; neither is the object to point out the factors leading to a diagnosis of chronic appendicitis. The reason for the paper is to report a series of cases, all very similar to the earlier mentioned hypothetical case of right lower quadrant distress that is so common in every physician's office. In this series we are humanly sure that there was no other intra-abdominal organic disease present, because of the careful preoperative examination and a thorough exploration through an adequate incision of the contents of the abdomen at operation.

To digress a moment, it is my opinion that the McBurney incision should be almost discarded as limiting the surgeon in the fulfillment of his duty to the patient upon whom he is operating for chronic appendicitis. At the end of such an operation he should be able to say to his patient and to put on record, "I looked at, or palpated the entire contents of your abdomen and pelvis, and their condition is as follows." If he merely removes the appendix through a small buttonhole incision that permits the patient to attend a dance ten or twelve days after the operation, he has very incompletely discharged his obligation as an abdominal surgeon.

And yet another digression:

The roentgenologist's diagnosis of "chronic appendicitis" has undoubtedly many times been the readily accepted salve to the conscience of and excuse for operation in the minds of surgeons because they have reported "chronic appendicitis" on inconclusive findings. I believe:

1. The non-visualization of an appendix should be a finding repeated several times before it may be accepted as evidence of disease.

2. Tenderness in the region of the cecum may not be sufficient grounds on which to base a diagnosis of appendicitis.

3. The observation of a beaded appendix or the shadow of fecoliths in an appendix is good evidence of disease.

4. The finding of an appendix shadow not freely movable because of adhesions,

or not separable from the cecum and colon is of diagnostic value.

5. An *x*-ray shadow of a clubbed appendix or one with the proximal end contracted and retaining the opaque substance some time after the large bowel has emptied out, is very suggestive of disease.

The drawing of a deduction of scientific value, from medical experience, is by no means a simple process. In many sciences the investigator has the power to control experience so that he can experiment; not so in medicine, for the limitation of a problem to one simple factor or one unknown quantity is always impossible.

It has been rather axiomatic in laboratory experimental work that controls be used to take account of the variables in a problem. That is particularly true in all animal experimental work. An example of the application of this principle of controls in the study of surgical problems or the surgical attack of disease in man does not appear in literature. This principle we have applied to a series of 57 cases treated surgically, and the fact that we have rigidly adhered to the principle of alternating the surgical treatment alone in these 57 rather similar clinical cases is an added reason for their presentation. In this series, the first case is dated January, 1924, and the last in January, 1929; that is, the cases extended over a five-year period ending one year ago. If this report has any value, it should be because of the end-result findings in patients so alternated and so controlled, running along simultaneously with one another and operated on by one man, under similar existing conditions over a period of years, rather than as is usual, in a series of patients operated upon consecutively compared with another series of patients operated upon during an entirely different period of time. A few years will involuntarily and unconsciously effect a distinct difference in the technique of a surgeon. Statistics are the best expression of medical experience because they are the most exact if properly prepared and compiled with skill.

The pessimism of the medical fraternity as to the cures after appendectomy in these cases of chronic appendicitis is so generally appreciated that I shall only quote a few phrases from the literature:

> "The rubbish heap of dyspepsia and chronic appendicitis."[1]
>
> "Forty per cent of operations for chronic appendicitis are a failure."[2]
>
> "Making a diagnosis of chronic appendicitis is equivalent to a confession of ignorance."[3]

These are expressive of the opinion of many leaders of the world's medical thought. These cases we have, like the poor, always with us. Many of them cannot, even after most painstaking observation and careful consideration be satisfactorily diagnosed; neither can they be refused operation because in many of them at exploration much is found wrong, and again a fixed idea in the minds of these patients is only relieved by the operation. There is no intention to advocate the refusal to operate upon the "chronic appendix" case; but if operation is to be made let it follow most careful study of the case with the object of determining the exact condition of affairs if possible, and then at operation let an exploration be most carefully made, and a preconceived diagnosis not bias the surgeon's work. It behooves every interne and every surgeon to read the rules laid down by Charles L. Gibson, "to avoid disappointing results after operations for chronic appendicitis."[4]

Because of the general unsatisfactory experience with the end-results of chronic appendicitis operations some six years ago, we began to add the operation of cecopexy to a limited group of appendectomies. My early training had been such as to look with the greatest disfavor on all the internal drapery operations, grouping them as bordering on quackery. Thus the reason for feeling our way and performing the combined operation on only the alternate case.

In a very considerable number of patients, 10 to 20 per cent, one may find if careful investigations be made, a tendency for the right colon and cecal head to sag down into the pelvis producing a pendulous cecum. The cecum alone or the entire right colon may be so slightly fixed to the posterior abdominal wall as to be practically attached by a mesentery so that the greater part of the colon's circumference is peritonealized, thus making possible the lifting of the cecum and ascending colon out of the abdomen as much as 3 or 4 inches. This condition of right colonic hypermotility or ptosis is often present without an appreciable general visceroptosis. Such a colon becomes a "water trap," a "cess pool." In addition to the vertical excursion, which may be as much as 6 in., marked lateral motility may take place. This anatomical condition is, of course, of embryological origin, as in the final stage of colonic rotation there is normally a gradual obliteration of its mesentery by a process of fusion of the peritoneal surfaces. Of the many erratic variations from the normal process of primitive mesenteric disappearance, the most common is an abnormal motility of the cecum or cecum and ascending colon. From the standpoint of surgery the cecum and ascending colon are one. Bryant[5] found 10 per cent of 290 subjects examined at autopsy, with visceroptosis of extreme degree and only 40 per cent had no visceroptosis. R. B. Carslow[6] says the condition is found three and one quarter times as often in females as males. The onset of symptoms in these patients is usually very indefinite as it is impossible to state when ptosis becomes translated to stasis. Most usually complaint comes at or following puberty or with the beginning of regular work at a trade or job, or in another group, soon after getting on their feet after pregnancy.

The complaint centers about distress in the right lower quadrant, which is more or less constant, or worse when the individual is tired and run down or constipated. He may call this stomach trouble or speak of indigestion. Gas and sour stomach may be complained of and even food and alkalie "relief" may creep into a history. The discomfort may be general in the abdomen and flatulence is referred to frequently. Pain may be present, but is very irregular as to time of appearance and duration; it is present for hours or days at a time with intervals of freedom of such variability that the patients may be considered to be neurotic. The pain is rarely a real acute pain. A majority of these patients are of course, constipated. Their color is not good, they are asthenic, drooped, and appear of lessened vitality. The blood pressure is usually subnormal. In the women, menstrual disturbances are more common. There is a loss of appetite and loss of weight. A tendency to exaggerate symptoms with development of introspective emotional moods may become part of the picture. Irritability is often present. Upon local examination the area of tenderness is quite widespread in the lower right side. Gas crepitation may be felt under the fingers, and the abdominal wall is flaccid or at least shows no signs of muscular stiffening. The *x*-ray findings I have referred to earlier.

Since the beginning of this study in January, 1924 there have been 57 patients, on 27 of whom cecopexy was added to appendectomy because it did not seem that the amount of disease found about the appendix was sufficient to account for the symptoms complained of by the patient. There have been no deaths and we have had a questionnaire reply from 27. There have been 29 "control" cases from whom 27 replies have been received. The following tables summarize the two series:

		Appendectomy and Cecopexy	Appendectomy Only
		28 Cases 27 Reporting 0 Deaths	29 Cases 27 Reporting 0 Deaths
Age Average:		24.4	24.2
Youngest		8	15
Oldest		43	39
Male:		7	4
Female:		20	23
Married:		6	9
Single:		21	18
Weight:		16 gained 81 lb. Average 5+ lb.	20 gained 15 lb. Average ¾ lb.
Length of operation:		35 minutes	24 minutes
Now feeling:	Well	10	5
	Better	13	14
	Fair	3	3
	No better	1	5
Appetite now:	Excellent	20	18
	Good	4	7
	Fair	3	2
Distress now:	None	17	None 10
	Few times	3	
	Some	4	Yes 17
	When tired menses cold	3	
Gas now:	None	17	13
	Better	5	4
	After starch	2	
	No change	3	10
Indigestion now:	None	20	None 14
	Better	5	
	Same	1	Yes 13
	Never any	1	
Constipation now:	Better	22	8
	Never any	4	3
	Worse	1	
	No better		16

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BLADDER TUMOR

A SURVEY OF FIFTY CASES*

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BLADDER tumors while extremely rare are by no means exceptional. They are more common in the male than in the female (4:1). In this series of 50 cases occurring in my private and hospital practice, and during my stay at St. Rockus Hospital, Hungary, I have tried to present the subject to the profession in the simplest manner possible. As a rule a histological specimen was examined in practically every case (90 per cent) so that not only a histological examination was made, but also a cystoscopic diagnosis of these tumors. In the final detailed report of these cases, I shall select the most interesting ones, describing not only the symptoms and the histological aspect, but also the clinical and cystoscopic interpretation of the same.

Bladder tumors for clinical purposes may be divided into three groups:

(a) Growths projecting well into the bladder. These are either papillomatous or pedunculated.

(b) Sessile growths projecting less into the bladder, spreading laterally along the bladder mucosa. Surface height in this type varies from 1 mm. to 3 cm.

(c) Infiltrating growths which invade every layer of the bladder and also surrounding bladder tissue. Infiltrating tumors always begin from surface epithelial growths, papillary or sessile, while sarcomata arise below the surface epithelium and show intravesical pedunculation or flat sessile masses on the bladder.

Histologically, bladder tumors are divided into benign and malignant. The principal benign tumor (85 per cent of all tumors) is the papilloma. Less frequently we see adenoma, fibroma, myxoma, etc. The most frequent malignant tumors are the malignant papilloma, papillary carcinoma, adenocarcinoma, and the epithelioma.

I will discuss briefly the most frequent of benign tumors, the papilloma. The use of the cystoscope with the high frequency current has deprived us of many histological classifications. In detail, the benign papilloma is always intravesical. Every malignant papilloma probably begins as a benign papilloma, the latter becoming potentially malignant in older patients at the cancer age. The benign papilloma begins as a tiny excrescence on the surface of the epithelium; an outer layer of epithelium, a core of connective tissue, and thin capillaries. It contains no muscle structure.

Malignant changes in a papilloma are as follows: thickening of the epithelial layers, multiplication of the layers, different staining characteristics of the nuclei, fusion of the papillae (two or three). The malignant papilloma is the same type of growth which invades the bladder (proper) and then is known as a papillary carcinoma. I make this distinction to keep separate the growths projecting entirely into the bladder (malignant papilloma) and the growths invading the walls of the bladder, namely, the papillary carcinoma. One of my cases (a benign papilloma) histologically and cystoscopically showed many implantations on repeated cystoscopic examinations. This is quite characteristic of malignancy, but nevertheless benign papillomata at times show the same spreading (implantation or inoculation).

Tumors of the bladder, both benign and malignant, occur in far greater frequency in the region of the trigone and ureteral orifices than in all other portions of the bladder put together.

Malignant changes are often not determined in the gross. The outstanding feature of malignancy is the thickening of the papillae, which are grayish and opaque, fusion of the papillae; and finally the

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growth may be converted into a solid mass, at times appearing sessile. Malignant papillomata recur, implant themselves in tumor, the more connective tissue we see. Oftentimes this tumor (adenocarcinoma) is called "papillary carcinoma" owing to its

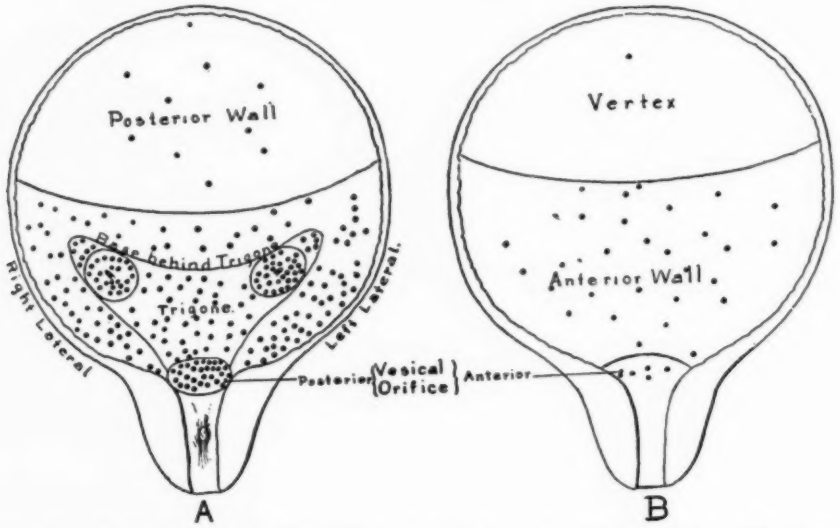


FIG. 1. Diagrammatic charts showing frequency of location of vesical tumors. Diagram prepared after careful selection of cases both of benign and malignant tumors. Note infrequency of tumors on vertex and high posterior wall, relative infrequency on anterior wall. Many at base (trigone) and ureteral and vesical orifices.

another section of the bladder, also the wound tract. Invasion of the bladder wall is not always easy to determine either at the base of the tumor or laterally. Inflammatory areola may obscure the diagnosis of infiltration in tumors, but makes the diagnosis of malignancy suspicious. Later the growth extends, encroaches on the lumen of the bladder, and irregular small thickenings may be seen on the bladder. If palpated, they are stony hard. Finally, infiltration and ulceration occur. Any type of malignant tumor may be invasive, and such a diagnosis as "invasive carcinoma" is not justified histologically.

Adenocarcinoma is rare (2 per cent). It arises from small gland groups in the bladder. Some of them resemble very closely the adenocarcinoma of the prostate; there are masses or nests of cells within which may be seen, open spaces, usually round, resembling gland lumina. The gland masses or nests are occasionally separated by thin connective tissue, fibrilla, sometimes a thin layer of dense cells. These groups of cells invade the lumen and walls of the bladder. The more invasive the likeness to that type. In gross, adenocarcinoma is always found at the base of the bladder, near the trigone or vesical orifices. This tumor may project into the bladder, also have a thick pedicle, but it is not papillary. More often it appears flat, and the rolled-out edges give the appearance of a mushroom. I bring this point out to show that a pedunculated tumor does not necessarily arise as a papilloma. Infiltration and hardness are seen around the tumor. Ulceration is common. There is no way to distinguish the ulcerative from any other type of malignant tumor.

Epithelioma is a distinctive type of tumor. As a rule the strands of cells and tissue penetrate the bladder from the epithelium. It heaps up upon the surface of the bladder and spreads laterally. At the point of growth we see the tumor cells invading the deeper coats of the bladder. Connective tissue between the nests of cells is not thin, as in papillary carcinoma, but thick and scattered throughout. Cells (clusters) are of squamous epithelium or basal cell type. In the squamous type, the cells become larger and paler toward the

center of the nest of strands, and intercellular fibrilla (prickle cells) may sometimes be seen. Pearls (epithelial) form in the center of the nest. Epidermization occurs. In one of my cases at the St. Rockus Hospital in Hungary, epidermization was not complete, and the cells were desquamated into a central cavity, and the nuclei could be seen. Such cells break down eventually into a granular debris, different from the concentric, keratinized layer of pearls; but the picture is definite and characteristic.

Why should squamous cell carcinoma occur in the bladder? A preexisting leucoplakia or some type of irritation is responsible for the same. Occasionally in squamous epithelioma exfoliation is seen and is quite characteristic of this type of tumor. In another type of tumor the tendency to epidermization is absent and the strands or nest are solid, not differentiated, into the central and peripheral layer of cells in the strands. The muscularis as a rule in the beginning is not invaded. In gross, epithelioma is a flat, sessile tumor, projecting very little into the bladder cavity. It spreads not as papillary carcinoma, deeply, but laterally. At times it assumes a wafer or mushroom-like appearance.

Sarcoma (mesothelial tumor) is an extremely rare tumor. I have never seen one. Geraghty states that it occurs less than 1 per cent of all bladder tumors. It begins underneath the epithelium, elevates the mucosa, and then becomes a sessile growth. I have seen a papillary tumor with a short, thick pedicle (pedunculated) which was reported "sarcoma" (histologically). The diagnosis was later changed to "papillary carcinoma." The cells here in this case were spindle-like, due to the compression of the cell growth; hence the discrepancy in histological diagnosis. This fact must be borne in mind, that bladder tumors may at any time present histological changes from one type to another. These sarcomata present the characteristic histology of any type of sarcoma seen elsewhere, either round cell, mixed cell, or spindle cell. The malignancy is determined by invasiveness, metastasis, cell changes, ulceration, etc. The tumor is

Fig. 2. Microscopical section of benign papilloma. Note uniform arrangement of papillae, and cells both central and peripheral. Various bladder layers are not invaded. Muscularis and connective tissue are normal.

apt to be confused with papillary carcinoma, as heretofore stated.

Fibroma is a rare, pedicle-like tumor; there is no infiltration or ulceration.

Of the heterotopic tumors, I shall mention only the dermoid. It is a very rare tumor; no case is reported in this series. Pieces of hair, etc., may be seen protruding from the center of the tumor. As a rule these are single.

Secondary effects of bladder tumors are manifested in bleeding, obstruction in the

ureter or urethra, necrosis, ulceration, encrustation, stone formation, infiltration of bladder wall, and infection. Bleeding is apt to be either in spurts or oozing. Obstruction is due to pressure of growth, or infiltration of growth into the urethra, ureter and rectum. Pain comes from pressure of growth on nerve-plexus. Ulceration is due to infection and pressure of cells on capillaries. There may be encrustation, due to deposition of urinary salts on tumors, or even actual stone formation. I have seen an encrustated papillary tumor which I thought was a stone. A stone searcher (cystoscope's tip) revealed the presence of a tumor, not of a stone.

FIG. 3. *Right.* Benign papilloma of bladder. Note regular arrangement of epithelial cells and presence of basal and peripheral layers (longitudinal section). *Left.* High magnification of two small papillae. Notice uniformity of layers. No tendency to become disorganized (cross-section).

Tumors may grow in a diverticulum, or start in the diverticulum and appear in the bladder cavity. I have seen one on the edge of a diverticulum. The nature of the growth was proved histologically (squamous cell carcinoma).

Metastasis as a rule is laid down in every textbook as "a late manifestation of bladder tumor." I have seen metastasis to the cervical and pelvic lymph nodes (2 cases). Oftentimes in our enthusiasm we fail to get *x*-ray pictures (hence the infrequency of metastasis.) Quite akin to this is the destruction of tumor by electricity, failing in this procedure to obtain histological specimens. Furthermore, the bladder itself may not be the primary site of the tumor; it may be secondary to renal neoplasm. I have seen 1 case of metastasis (implantation) from the renal pelvis to the bladder; hence the use of the cystoscope and the *x*-ray. The type of tumor in the kidney (renal pelvis) most often seen is the papillary carcinoma or the benign papilloma.

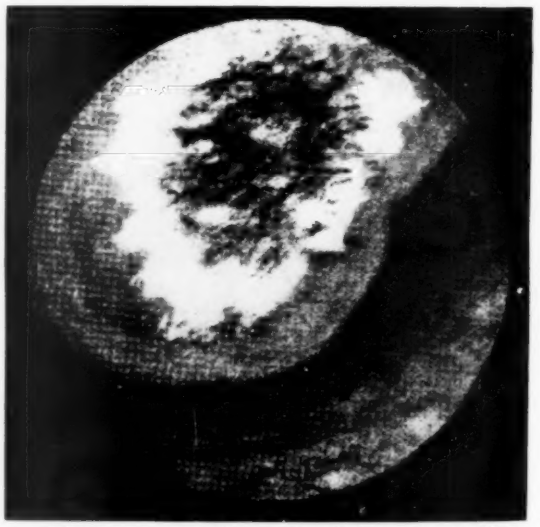
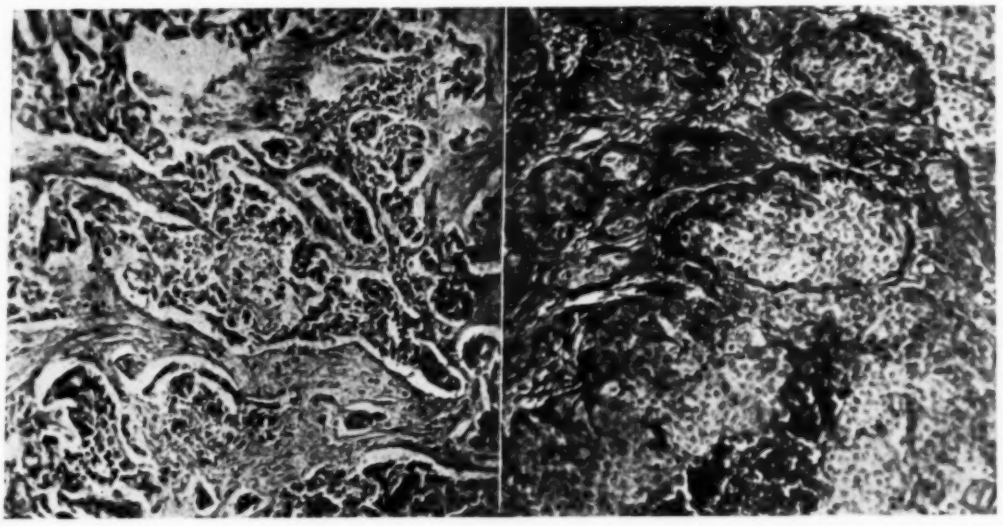


FIG. 4. Malignant papilloma after fulgurating (Clinic of Von Illy's, Budapest).

I have on one occasion mistaken a blood clot for a bladder tumor. The patient's symptoms were entirely vesical; nevertheless I brushed away the blood clot and saw bloody urine issuing from the ureter. Diagnosis, confirmed by cystoscopy and operation, proved it to be a malignant tumor of the kidney.



R. L.

Fig. 5. *Right.* Papillary carcinoma of bladder. Large mass of tumor cells, center of which is undergoing necrosis. Process precedes ulceration, which is common in these tumors. *Left.* Epithelioma of bladder. Picture is given to contrast with one on right and illustrates much greater tendency to necrosis in epithelioma.

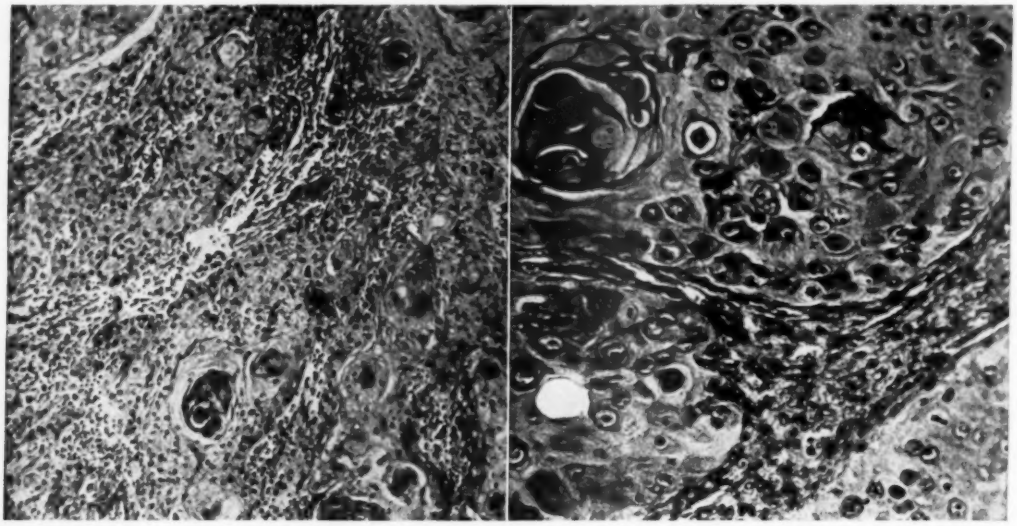
Sometimes bleeding is the first and only symptom of bladder tumor; it certainly is the most frequent. It occurs in 90 per cent of all bladder tumors. It is a painless hematuria. In many of my cases bleeding was symptomless, in contradistinction to the bleeding of lithiasis or tuberculosis. Hematuria may last for three or four weeks, then stop for an interval for days or months, only to recur at a later period. The proper time to cystoscope your patient in bladder tumors is when bleeding ceases. If the patient is cystoscoped at the time of bleeding the examination is unsatisfactory. Oftentimes a diagnosis of bladder tumor can be made when so much bleeding ensues that cystoscopy is a failure.

In renal neoplasm, just the opposite, cystoscope at the time of bleeding. Very much less blood comes from your ureter than from your bladder at the time of cystoscopic examination; hence my argument as to the proper time to examine patients with tumors in regard to bleeding. I recently attempted to cystoscope a bladder (tumor) when bleeding was excessive. It was quite unsatisfactory, but nevertheless I could faintly see the tumor. Later when bleeding had ceased I examined it cystoscopically and saw a malignant papilloma with a spurting orifice on the tip of same. Just now at this point I wish to stress the importance of the high frequency current applied rather vigorously to bleeding points of tumors. I have used it successfully on two occasions, the bleeding having ceased after its application. A recent case of bleeding following the expulsion of small stones led me astray for a short while. Plain *x*-rays were negative. I allowed the patient to go, but to return in one month. I then cystoscoped her. To my surprise I saw three benign papillomata. Most fortunately they were benign tumors as they all responded to vigorous fulguration. The gravel was simply coincident in this case; the tumor, I think, caused the bleeding.

Pain is generally a late symptom of bladder tumor and is due to cystitis or invasion and infiltration of surrounding nerve-plexus. Blood clots in themselves

cause a good deal of pain. The advent of pain always signifies advanced malignancy of tumors. When such a condition exists, kidney. Disintegrated, disorganized clots mean bladder tumor as a rule.

Squamous cell carcinoma gives a flakey



R. L.

Fig. 6. *Right.* Squamous cell epithelioma of bladder (epidermoid carcinoma). The absolute typical architecture of the growth is well shown. Analogous to squamous cell epithelioma of skin. *Left.* Higher magnification of same type of tumor. The cell's characteristics and a small white pearl are shown.

radical procedure is out of the question. Occasionally advanced (ulcerating) carcinoma cannot be detected with accuracy through the cystoscope. Induration of the bladder wall as felt through the vagina or rectum is helpful.

In résumé, a bladder tumor is caused by hematuria out of a clear sky. The hematuria is intermittent. I have seen a papillary carcinoma bleed for several weeks. It was necessary to fulgurate the tumor several times before cessation of bleeding occurred. Such a symptom (bleeding) demands an early cystoscopic examination to determine the renal or vesical source of bleeding. Hematuria is never negligible; it should be investigated immediately. The cystoscope is the most valuable means at our disposal in the examination of bladder tumors. I depend entirely upon the use of the cystoscope in these cases. In flat, non-elevated, infiltrating growths, where no projection into the bladder can be seen, examine by other methods (rectal or vaginal). Worm-like clots as a rule spell bleeding from the urine, resembling the flakes we see in leucoplakia.

Cystograms are helpful in advanced carcinoma filling the bladder, but as a rule by that time the diagnosis can be made by clinical findings alone; hence there is no real value to the *x*-ray in bladder tumors.

I will now attempt to divide tumors of the bladder as they occur when seen cystoscopically. In this cystoscopic division I am able to diagnose and watch the very progress of treatment in these cases. It has been of tremendous help to me in gauging the different forms of therapy. This classification may be entirely different from that of other observers, but nevertheless it has served me well. With this classification I can as a rule determine malignancy, substantiated of course by the histological examination to determine the type of malignancy. In ulcerating tumors the cystoscope will fool you; specimens must be taken. The efficacy of the various types of treatment can be gauged cystoscopically. The successful

treatment of bladder tumors depends not so much on the histological aspect of the tumor as upon the cystoscopic interpretation. Therefore, this classification I have found helpful in many cases:

(a) Papilloma, single or multiple.

(b) Papillary, non-infiltrating tumors, showing tendency to lateral spread (single or multiple).

(c) Tumors with intravesical mass (non-papillary) showing infiltration of the bladder wall and early ulceration.

(d) Low infiltrating type. No elevation or only slight intravesical intrusion.

(e) Pedunculated non-papillary do not infiltrate. They are generally benign.

(f) Sessile tumors which are non-papillary are non-infiltrating, with a question of malignancy.

Group A. These tumors are quite distinctive cystoscopically. They have a distinct pedicle (long or short), one main branch and many small, slender fibrillae extending from the main branch. The tumor simply melts away with one blast of the high frequency current. If the tumor remains distinctly globular it is benign as a rule; but if it becomes a little bit flat or sessile, with a stubby pedicle, look out for malignancy. Slight inflammatory areola suggests malignancy; it also tends to obscure hard infiltrations at times.

Group B. Papillary, non-infiltrating, showing tendency to lateral spread. This tumor constitutes a definite cystoscopical entity. It is most characteristic of all tumors as seen through the cystoscope. It comprises about 15 per cent of all bladder tumors. Just what to do for this type of tumor therapeutically has been a source of perplexity to me. There are no distinct separate papillae. The tumor is massed, the surface is irregular. The top of the tumor is apt to be soft, while underneath the top a distinct hardness is felt. It seems as though the tumor were cemented into the bladder wall. It does not infiltrate laterally in the beginning, but in a downward direction into the bladder wall. This is characteristic of this type. I have actually seen it on two or three occasions. The edges of these tumors slope down to the bladder mucosa. This

Fig. 7. Cystogram showing irregular filling defect on right at arrow. Advanced carcinoma of the bladder. (St. Vincent Hospital, Worcester, Mass.)

type of tumor is single or multiple, generally the former, dimensions varying from ½ in. to 2 in. in diameter, and ½ in. to 1½ in. in height. Small grouping tumors scattered over circumscribed areas of the bladder may be seen. Infiltration is in a downward direction; lateral infiltration and ulceration are late signs. When ulceration does occur, it does not present the deep serpiginous ulceration of Group C, but is a superficial ulceration occupying a greater portion of the bladder. At this latter period this tumor gives the picture of Group D (to be described later). Occasionally one may see a very early stage of epithelioma resembling this picture, but ulceration is usually present in the very beginning; however, an epithelioma invades early and is usually seen in the ulcerated form described under Group C.

Group C. Tumors with intravesical intrusion (3 cm. or less), infiltrating and ulcerating.

(a) Represents any late manifestation of any previous group.

(b) Flat sessile type (adenocarcinoma and squamous carcinoma) may appear like Group B of the low papillary type.

FIG. 8. Papillary carcinoma of bladder (resection). Notice invasiveness of this tumor. (Clinic of Von Illy, Budapest.)

Group D. Ulcerating group (late type of any previous group). These tumors cannot be differentiated cystoscopically. They show early invasion, infiltration, ulceration and metastasis.

Group E. Pedunculated tumors. These may resemble the fused papilloma (malignant). I once mistook a pedunculated tumor for a fused papilloma (malignant). The treatment is the same, fulguration. Histological specimens will clarify the situation.

Group F. Sessile tumors, non-papillary and infiltrating. Histologically benign tumors.

There are various lesions in the bladder which resemble carcinoma, viz., chronic cystitis (ulceration). Treatment suffices to clear the diagnosis. Specimens will clarify the situation.

Solitary ulcers. Specimens and treatment. The former are more important as treatment in solitary ulcer is at times anything but satisfactory.

Tuberculous ulcers, other signs of genito-urinary tuberculosis. Tuberculous germs in the urine. Pale urine. Sterile pyuria. Guinea pig tests repeated.

Hypertrophy of the prostate gland, cystoscopy, median lobe, etc. I once made a diagnosis of a median lobe for bladder tumor. A tumor presented itself with a distinct pedicle, almost the size of a hen's egg. It caused definite symptoms of prostatism. No bleeding. Residual, 12 oz. On opening the bladder a pedunculated tumor presented itself. Anatomically it occupied a position corresponding to sub-trigonal glands. Histological report was masses or nests of gland tissue with lumen in the center, probably an adenoma of the sub-trigonal glands, the so-called aberrant prostate gland. It could not be definitely classified as hypertrophy of real prostatic tissue; it had no connection whatsoever to the prostate gland as the prostate occupied a position below the tumor, with a groove between the two.

The treatment of 50 cases of bladder tumor, both benign and malignant, convinces me that excision of tumors as generally carried out is not the method of choice. The high frequency current, through the cystoscope or by open operation (suprapubic) when vigorously applied even in apparently hopeless cases has worked out well. The results in the past of the treatment of bladder tumors have been so unsatisfactory in my hands, owing to many factors (late diagnosis) that any method was welcome. Radical excision or resection as generally practiced did not seem to relieve the condition, in many cases causing aggravation of symptoms with implantations and metastasis. Later on the introduction of cautery and high frequency for excisions and resections made another advance in the progress of therapeutics of bladder tumors.

Radium in the form of radon seeds, used as a adjuvant to other types of treatment, has worked to my satisfaction.

Fulguration with the bipolar high frequency current for benign growths is the method of choice for this histological type of tumor. It is also the proper method to use in excision or resection of other types of growth (malignant). Whenever possible, resect (high frequency) malignant growths; if not possible, just use the high frequency to excise. If not excisable, just do a direct fulguration with high frequency or cautery. The application of radium, as stated previously, is used only as adjuvant to other treatments. Just a word about radium. It is very much easier to plant radium through a suprapubic wound than through the cystoscope. Too large tumors should be radiated from above. The placing of radon seeds should be checked up with *x*-ray. On several occasions many of my seeds have not remained in situ. The seeds are removed within five days by the cystoscope, or other means available. Young of Baltimore has devised several cystoscopes for direct application of radium element. With these I have had no experience, so my conclusions would not be worthwhile.

Finally, in the treatment of malignant growths of the bladder, especially those that are invasive and ulcerative (advanced malignancy), radical treatment in such cases only tends to aggravate the condition. Palliation should be given in the form of deep *x*-ray therapy for the relief of symptoms and finally suprapubic cystotomy. On one occasion I attempted to attack this type of tumor with fulguration and radium. It was not well selected and the results were not good. Palliation would have served the purpose a good deal better, or possibly diversion of the urinary stream into the rectum or skin.

For the benign papillomata the treatment is one or many applications of the high frequency current. In many clinics, especially during my stay at St. Rockus Hospital in Hungary, the method of snipping them off with knife and scissors was employed.

Multiplicity of tumors (benign papillomata and malignant papillomata) as a rule requires open operation with the application of cautery or high frequency. Cystoscopic fulguration in these cases is not practical.

Tumors are handled more or less according to location. Tumors in fixed portions of bladder (most frequent position) must be treated preferably with cautery or high frequency; as a rule they are not resectable, and are malignant. Tumor (malignant) in the dome of the bladder near the anterior wall can be resected with the high frequency needle. A good rule to follow is to excise or resect with high frequency if you can; if not, just fulgurate vigorously with the high frequency current. This method necessarily demands an open operation. Radium in the form of radon seeds in the treatment of small growths (malignant) can be applied through the cystoscope. With larger and multiple growths (malignant), direct application through a suprapubic sinus is employed. I generally use platinum radon seeds, estimating my dose by the size of the tumor. I believe that the combination of high frequency plus radium works well in certain types of malignant growths. Depending on size of tumor, they may be applied cystoscopically or through open operation (cystotomy). Radon seeds are removed in three to five days, are planted about 1 cm. apart. Young applies his radium with cystoscopic applicators which are fixed in position by an adjustable screw to the table. Barringer uses practically all seeds in treatment of bladder tumors.

X-ray (deep therapy) can be used as an adjuvant to other types of treatment. It is only a palliative measure and simply relieves pain. Inoperable carcinoma, not only of the bladder but of the prostate, can be handled in this way. It seems to relieve the pain of metastasis; whether it has any curative value I cannot say.

In concluding this article, before tabulating my results in bladder tumors, I wish to state emphatically that the progress in the treatment of bladder tumors has advanced in the last fifteen years, that

TABLE 1

Treatment	Papilloma	Malignant Papilloma	Papillary Carcinoma	Infiltrating Carcinoma { Adenocarcinoma / Squamous Carcinoma
Fulguration (cystoscopic). One to fourapplications	15	5	0	0
Fulguration by radon seeds (cystoscopic). One to four fulgurations. Only one application of radon seeds	2	6	0	0
Fulguration (suprapubic without radon seeds	1	1	2	1
Fulguration (suprapubic) with radon seeds	2	2	2	1
Radon seeds alone either with the cystoscope or suprapubically	0	0	1	0
Excision (suprapubic) with radon seeds	0	3	2	0
Resection alone	0	0	1	1
Other treatments such as *x*-ray (deep therapy), punch operations and cystotomy	0	0	0	1
Mortality rate of all tumors 18 per cent	0	12 per cent	75 per cent	75 per cent
Results	Excellent. No deaths. All living to date	Good. 2 deaths, 1 ten days after treatment, 1 six months afterward. All others living to date.	Poor. 6 deaths. 1 alive 3 years, 2 alive 4 years. Other 6 died within 1st year.	Poor. 3 deaths, all within 2 years. 1 living to date.

bladder tumors must be diagnosed early, and that proper medical and surgical treatment should be applied. The cessation of hematuria gives the patient false hopes, but sooner or later the bleeding recurs and the disease is beyond surgical treatment.

The bleeding of carcinoma of the prostate (which may be a little amiss here) is not too frequent a symptom. In fact, I have very seldom seen bleeding as an initial symptom of prostatic carcinoma. Not so in bladder tumor; the initial symptom (painless bleeding) requires early investigation. Better methods of diagnosis and more careful examination of bleeding from the urinary tract (bladder) can help to a great extent the future outcome and successful therapy of bladder tumors; also a histologically benign tumor is potentially malignant at any time; the delay in diagnosis renders a condition not only inoperable, but also leaves an intolerant bladder which we are not able to cystoscope. Also, the term "essential hematuria" is a misnomer; the term "idiopathic" is much better, although it, too, is not quite appropriate.

My ideas in this article were formulated over a period of five to ten years in han-

dling this special aspect of urology; also during my stay at St. Rockus Hospital in Hungary where I was able to examine many cases of bladder tumors. In that section of the country bladder tumors seemed to be quite common. The treatment in that clinic was the same as practiced in clinics in this country. The only advance I could see was the number of surgical cases available, and various forms of local anesthesia employed. The anesthesia used in bladder tumors (benign and malignant) was caudal anestheisa plus suprapubic field-block. I was not impressed with this type of anesthesia for bladder tumors. In the higher urinary tract operations paravertebral anesthesia was used. It is a very good form of anestheisa in some cases, but not in all. I think that ether is the anesthesia of choice for kidney operations, so I conclude this article with that brief summary stated before.

CASE REPORTS

FUSION OF KNEE-JOINT*

A. DeF. Smith, M.D.

NEW YORK

THE patient was a woman forty-eight years of age, who was seen at the New York Orthopedic Dispensary and Hospital for the first time in 1921. She then had the typical physical signs of tabes dorsalis, including contracted pupils which did not react to light or accommodation, and with absence of patellar reflexes. She was also having severe pains in both legs which were characteristic of this disease. The left knee-joint was enormously swollen and greatly relaxed, with an abnormal degree of motion laterally and in hyperextension. The joint was not painful or tender.

A brace was made which she wore for the following six years with very little satisfaction, although it did increase the stability of her knee. It was then thought best to attempt a fusion of the joint, and an operation was preformed in October, 1926. It was found that the lateral tuberosity of the tibia was entirely gone, and was represented apparently by a large, loose body. There was no vestige of the crucial ligaments and the joint was extremely relaxed. The cavity was filled with a large number of loose bodies of all sizes, many of which were in the posterior compartment. The articulation was largely gone, the articulating surfaces being covered with smooth, eburnated bone. Many of the loose bodies were removed but no attempt was made to take those from the posterior compartment. The eburnated bone of the tibiae and femur was chiseled off and some of the medial tuberosity of the tibia was cut off in order to correct the valgus deformity. The patella was removed from its bed and was mortised between the tibia and femur. The knee was immobilized in plaster for five months, at the end of which time it seemed solidly fused.

She has now been walking for about one year without support and with much greater comfort than before the operation.

It should be stated that two other similar operations have been done at the New York Orthopedic Hospital, one of which was a complete failure and the result of the other is still in doubt. It is evident that this is not a procedure which will be successful in every case.

DISCUSSION

Dr. Paul W. Lapidus: About two years ago, on Dr. Leo Mayer's service at the Hospital for Joint Diseases we had a similar case where an arthorodesis of the knee-joint was also attempted without however obtaining such a brilliant result. It was a case of a woman about fifty-five years old with typical signs and symptoms of tabes dorsalis and a Charcot's knee which was operated upon. A large bone graft was taken from the anterior surface of the lower third of the femur, and slid down into a bed prepared for it over the upper third of the tibia after thorough resection of the knee-joint; but the knee did not fuse in spite of an immobilization for several months. I saw her a few months ago: there was still webbling in the knee-joint which necessitated wearing a brace.

* Submitted for publication June 4, 1930.

LARGE THERAPEUTIC DOSES OF TETANUS ANTITOXIN*

JAY IRELAND, M.D.

CHICAGO, ILL.

GRANT P. PENNOYER[1] states that a total dosage of 130,000 units of tetanus antitoxin was administered to his patient which is the largest he has been able to find in the literature given to a single patient with recovery. Freedlander[2] reports 4 cases, age eight to thirty-four years, receiving from 188,000 to 755,000 units, all with recovery. Most of it was given intravenously. Strock[3] gave almost 4½ pt. divided into 222 injections to 1 patient, to another 720 c.c., and to another 1400 c.c.; all 3 patients recovered. The total number of units was not stated. Bruce[4] treated 7 cases with from 100,000 to 249,000 units, one patient recovering. Woolf[5] gave 172,000 units intravenously, some intraspinally, and some intramuscularly (amounts of these not stated) with recovery. Caffrey[6] gave 112,500 units with recovery, giving some of his doses as frequently as every two hours. Young[7] gave 150,000 and 220,000, respectively, to 2 patients with recoveries. Van der Bogert[8] gave 587,500 units to a patient who recovered. MacCokney[9] also recommends large therapeutic doses of tetanus antitoxin.

The tendency now is to give larger doses of tetanus antitoxin than previously. Many of the patients, however, given extremely large doses, do not recover because of the marked severity of the infection and the greater number of days the infection lasts. There seems to be little or no evidence of untoward results from these extremely large doses of antitoxin.

The following case is of interest because of the large amount of tetanus antitoxin given with recovery:

H. S. Male, white, aged eight years, American, entered the Children's Memorial Hospital Aug. 24, 1929. On August 17, the patient lacerated his left wrist with a glass jar; the wound was 1½ in. long. At the time of injury, wound was washed with peroxide and mercurochrome; considerable bleeding ensued. On the day of admission he complained of stiff neck, fever, and set jaw. Past history is uneventful. Physical examination reveals temperature 99.2°F. Pupils react to light and accommodation but eyes do not follow objects well. Lower jaw is set with teeth 1 in. apart. Left wrist has laceration 1½ in. long which is quite dry, ragged, and red. Muscular rigidity is present throughout the body. Kernig and Brudzinski signs are positive. There is considerable pain caused in attempts to elicit these signs. Knee jerks are exaggerated, and abdominal reflexes are not elicited. Spinal fluid drawn August 27 (three days after admission) contains many pus cells. Smears of the spinal fluid contain no bacteria; blood agar plate culture made in the ward contains a Staphylococcus which is considered a contamination because the same fluid cultured in the laboratory has no growth.

Diagnosis: tetanus.

On admission of the patient 20,000 units of tetanus antitoxin were given intramuscularly and 20,000 units intravenously. The following day the patient's condition was worse. At this time 20,000 units were given intramuscularly, 20,000 intravenously, and 10,000 intracisternally. On the third day the temperature was 105°F. and swelling of the neck had increased. On this day 15,000 units were given intraspinally, 20,000 intramuscularly, and 20,000 intravenously; but none intracisternally because of a marked edema at site of the cisternal puncture. The fourth day after admission the temperature was 103°F. Muscle spasms and rigidity were somewhat decreased. Spinal fluid was under increased pressure. Temperature was 102°F. Because the patient was still quite ill, 20,000 units were given intramuscularly and 20,000 intraspinally. The fifth day, the child had muscle spasms when touched. On this day 20,000 units were given intraspinally and 20,000 intramuscularly. The seventh day (thirteen days after the injury) he was still listless and stuporous when 20,000 units

* Submitted for publication October 23, 1930.

were given intraspinally and 20,000 intramuscularly. The total number of units given was 265,000.

The tetanus was accompanied and followed by several complications. A continuous fever was present from the time of admittance till September 20 (twenty-seven days). Following this an intermittent fever was present the succeeding twenty-three days. Impetigo of the face occurred on the fourth day after admission and lasted nine days. Urticaria, probably on a serum basis, developed on the seventh day and lasted six days. Furunculosis began the thirteenth day and lasted six days. Also, on the thirteenth day, diarrhea and bloody stools (enteritis) developed. The enteritis lasted eight days. The patient recovered October 16 (fifty-three days after admission).

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A NEW OPERATION FOR THE CURE OF PARALYTIC GENU RECURVATUM

A PRELIMINARY REPORT*

Leo Mayer, M.D.

NEW YORK CITY

In 1918 Willis Campbell advocated implanting the patella into the tibia with the object of producing a bone block which would prevent hyperextension. This method I have found difficult of execution and ineffective in curing marked grades of recurvatum; it suggested to me, however, the possibility of creating a bone block strong enough to do the required work. An analogy to this type of block is found in the olecranon process of the ulna which effectually prevents hyperextension of the elbow. The purpose of the operation was therefore to convert the knee-joint into a structure resembling the joint between humerus and ulna.

Early in 1927 the first of these bone block operations was done.

The patient, a girl of twelve, had a recurvatum of more than 50°. She was completely crippled by the deformity which was so severe as to make the use of a brace impossible. The operation was done as follows: An 8-in. midline incision was made, beginning 4 in. above the patella and running down to the tuberosity of the tibia. The skin was dissected back sufficiently to expose the lateral recesses of the joint. An inverted v-shaped incision was made through the quadriceps tendon, running downward through the joint capsule on each side of the patella to within an inch of the lateral ligaments. By retracting the patella downward this incision gave free access to the joint. To give a better exposure of the upper end of the tibia, the ligamentum mucosum was divided and part of the retropatellar fat pad was excised. A 1½ in. chisel was then driven vertically downward into the tibia for a distance of 1 in. The cutting edge of the chisel was placed at right angles to the anteroposterior axis of the knee, just between the attachment of the anterior crucial ligament and the internal

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meniscus. That portion of the tibia lying anterior to the chisel was pried gently forward, so as to make room for a bone graft. This was taken from the anterior surface of the femur, including a part of the cartilage-covered condyles. It measured 2 in. long, 1½ in. wide at the distal end, ¾ in. wide at the proximal, and a little less than ¼ in. thick. With the smooth surface facing the joint (that is, looking posteriorly) the graft was driven downward into the tibia, leaving about 1 in. projecting from the upper surface of the tibia. The surface of the patella was next denuded of cartilage. It was found that the raw surface of the patella made good contact with the raw surface of the graft, thus insuring a solid union between them. The incision into the joint and quadriceps tendon was closed by continuous chromic stitches, the skin with a continuous fine plain gut. The leg was immobilized in plaster-of-Paris at an angle of 90° and kept in this position ten weeks. The operation cured the deformity and the patient is now able to walk.

Since then 11 additional patients have been operated on. In all of them the recurvatum has been entirely cured. In fact the cure was so effectual as to indicate clearly the danger of the operation, namely, the development of a flexion contracture. This can be avoided by diminishing the period of immobilization to four weeks. This has the added advantage of increasing the ultimate range of motion. In the earlier cases there was only about 40° of motion following the operation, in the last 4 cases there has been from 90 to 120°.

Another modification has been the use of a tibial graft instead of the femoral. This graft though somewhat narrower than the femoral is much easier to insert into the tibia. I have used it in the last 6 cases.

There have been no infections in this series of cases nor any postoperative complications except, (1) the formation of a postoperative hemarthros, in one patient necessitating a secondary arthrotomy to evacuate the blood clot, and (2) the development of a 20° flexion contracture due to too large a block. This was relieved by a second operation in which the upper part of the bone block was chiselled away.

ASTRAGALECTOMY

ULTIMATE RESULT*

Armitage Whitman, M.D.

NEW YORK

DR. WHITMAN reported the following case: A patient, a girl seventeen years old came to his clinic four days ago, stating that she was an old patient of the hospital. As he looked at her he was unable at first glance to detect anything abnormal, nor could the other members of the staff.

Examination, and the hospital records, showed that she had been operated upon by Dr. Royal Whitman in January, 1919, for calcaneus deformity due to complete paralysis of the calf muscle from anterior poliomyelitis. The operation was the typical Whitman operation of astragalectomy and backward displacement of the foot. The patient now engaged in all normal pursuits, was conscious of no disability, and was regarded by her associates as normal. In other words she presented an ideal result of the operative treatment of paralysis of the calf muscle.

Dr. Armitage Whitman said that he was particularly interested in showing the patient in view of an article by Mr. Naughton Dunn[1] in which Mr. Dunn stated that "further experience has satisfied me that this operation of astragalectomy should not now be taught or practised for the treatment of any type of paralytic deformity of the foot."

It was evident that Mr. Dunn, in common with many observers in this country, had failed completely to grasp the essential difference between the Whitman operation and any other stabilizing operation on the foot, namely:

[1] Dunn, N. *J. Bone & Joint Surg.*, April, 1930.

* Read before the Section of Orthopedic Surgery, New York Academy of Medicine, April 18, 1930.

that after the Whitman operation dorsal flexion of the foot was checked at a right angle.

When the patient was properly trained to walk with the foot straight ahead, and to walk *over* the foot instead of putting it out to one side the checking of dorsal flexion endowed the foot, as the patient came up on her toe, with propulsive power. Any type of arthrodesing operation might give a satisfactory cosmetic result, but this essential and most important functional feature was lacking. Unless dorsal flexion was checked at a right angle the gait remained the same awkward, passive, clumping heel walk typical of calcaneus deformity.

This patient, therefore, presented a practically perfect cosmetic and functional result of the operative treatment of isolated paralysis of the calf muscle. Dr. Whitman stated that he thought it a sufficient tribute to the worth of any operation to be able to demonstrate that the mechanics of the operation could compensate for the loss of power of one of the two strongest muscles in the body.

DISCUSSION

Dr. Samuel Kleinberg: I can only emphasize what Dr. Whitman has already said. It is rather amusing to us who are acquainted with the operation of astragalectomy and backward displacement of the foot to hear it spoken of as a difficult operation and as a mutilating operation. In the hands of the experienced the removal of the astragalus is one of the simplest procedures. Any one of us can remove the astragalus within two or three minutes and complete the whole operation from beginning to end in little more than fifteen minutes. Not only is the operation fairly simple but it disturbs the structures of the foot and ankle far less than any other reconstruction operation about the ankle. In the Hoke operation, for instance, one removes the head of the astragalus, reshapes the head, removes the cartilage from the navicular bone, replaces the head, and in general one traumatizes many more structures than in the astragalectomy operation. But the most important feature of astragalectomy is not that it is a simple operation and easily performed, and not that it traumatizes the tissues far less than other reconstruction operations, but that the results can always be anticipated with accuracy. In a properly performed astragalectomy with backward displacement of the foot, one is certain that he will get a symmetrical, stable, dependable foot, and that is much more than can be said for any other type of reconstruction operation on the foot.

I had recently a physician from Cologne visit our clinic at the Hospital for Ruptured and Crippled. He had been traveling for many weeks throughout this country and said that he had visited some thirty clinics but that in none of these had he seen the operation of astragalectomy and backward displacement of the foot performed. As the operation is well known and was evaluated by a committee specially appointed by the American Orthopedic Association to study the various stabilization operations in the ankle joint, as the most efficient procedure for stabilizing the ankle, I can only adjudge our visitor's experience on the basis that the surgeons in the various clinics he visted were ignorant of the details of the operation and its valuable permanent effects.

I am very glad that Dr. Whitman demonstrated his case before the Section. The result is unusually good. We cannot get equally good results in 100 per cent of the cases but we certainly do in the vast majority of instances.

One word of conclusion: When we think of a stabilization operation for a paralytic ankle, we must remember that of all the operations, many of which are quite satisfactory, the Whitman astragalectomy with backward displacement of the foot gives the best results, yielding in the vast majority of cases a strong, symmetrical and dependable foot.

Dr. E. D. Oppenheimer: This astragalectomy has given a perfect result and the case demonstrates how well a patient can walk if the pelvic muscles are intact. Unfortunately most of the cases on which an astragalectomy is done have also a marked paralysis of the rest of the lower extremity, and that is the reason why this patient walks so very well and the other cases with just as good an operative result walk so badly.

Dr. Whitman, (*closing*). It seems almost impossible to restrict the discussion to one subject alone. In reply to Dr. Oppenheimer's remarks on paralysis of muscles about the hip I will restate that I showed this patient as a case illustrating the treatment by the Whitman operation of isolated paralysis of the calf muscle. I thought it of interest to show how the result of an operation properly performed and given the necessary postoperative care and education, might entirely conceal the complete paralysis of the strongest muscle in the body.

AN UNUSUAL CASE OF BREAST ABSCESS*

GAYLORD S. BATES, M.D.

DETROIT, MICH.

BREAST abscess is a surgical condition of relatively rare occurrence. By far the greater percentage of cases occur in women during lactation or, less often, in pregnancy. Fleck[1] collected 430 cases from the literature and found only 5.8 per cent occurred during pregnancy. Billroth, Nunn and Bryant[2] among them collected 230 cases of abscess of the breast, of which only 34, or 14.7 per cent were unconnected with pregnancy or lactation. The sources of infection in this smaller group are as interesting as they are varied.

Velpeau[3] described a case which he saw in 1844:

> . . . vast abscess of the right breast, consequent on purulent formation in the axilla which, in turn, was consequent on chillblains; [and] an axillary abscess, consequent on erysipelas produced by a blister on the left arm; incision with free drainage; abscess of the left breast; incision; poultices; cure in five weeks. [Velpeau's experience with uncommon forms of breast abscess was apparently rich, for] I have seen an abscess form beneath the mamma, consequent on the inflammation and suppuration of the perichondrium of a broken sternocostal cartilage. In many other patients the abscess has been caused by some long standing change in the subjacent ribs. In 1834, I met with an enormous submammary abscess communicating with the bronchi which followed an attack of pneumonia of seemingly mild character. In 1836, there was a woman in La Charité in whom the abscess originated in a tuberculous mass under the sternum. At the same time a young girl had one which arose between the anterior border of the right lung and the costal pleura. Pulmonary phthisis is a source of them which should not be forgotten, and of which I have witnessed many examples. I have also seen a great variety of submammary abscesses arising from various diseases of the chest in which instances, in short, they were little more than depots from gravitation.

Shield[4] reports many cases of breast abscesses where the origin could not be discovered, and speaks of the rarity of this condition in pyemia though cases are on record where such was the case, as after a recent operation or septic abortion.

Deaver[5] first called attention to those rare instances where an abscess of the breast occurs independently of lactation and in the absence of a history of trauma. These cases occur almost without exception in patients whose nipples and areolae are congenitally deformed. He quotes 2 histories of Duvergey where the phenomenon is attributed to malformation of the nipple which, being sunken, would easily become the receptacle for dust, and retain the secretions of the skin in which the microorganisms are plentiful.

Many cases have a direct and immediate relation to trauma or wounding of the breast. Fitzwilliams[6,7] reports many such cases, believing that suppuration after definite trauma, such as a blow, is due to the effusion of blood, the formation of a hematoma, with subsequent suppuration due to the lodgement of organisms in the clot. In 2 instances there was no history of trauma. In 1 case, a pure culture of staphylococcus was obtained from a breast abscess following a sore throat of influenzal origin; again, in a woman who had been in poor general condition for some months a breast abscess occurred following the appearance of several abscesses about the mouth. Davis[8] observed 1 case which followed the scalding of the breast with coffee, a pure culture of streptococcus being obtained from the abscess.

Breast abscess caused by B. typhosus following typhoid fever, is one of the rarest of complications in that disease, yet by 1915 there had been 32 authentic cases

* Submitted for publication September 5, 1930.

recorded. Gerlach,[9] Schiffmann,[10] Snoke and Goforth,[11] have each reported a case since that time; and Dyke[12] has reported 1 case occurring in a typhoid carrier.

Oxley[13] witnessed a suppurating breast in which gonococci were found to be the exciting organism. This patient had a primary genital focus of three weeks' duration. The manner in which the gonococcus became implanted in the breast is not stated. According to Fitzwilliams,[6] this is the only case of its kind to be found in the literature.

CASE REPORT

Case No. 46956, married, white, housewife, aged fifty-five, entered the surgical service of Drs. McLean, Barrett, and MacKenzie, May 5, 1930, complaining of swelling of the right breast with pain, fever, and anorexia of three weeks' duration.

About three weeks before entry the patient noticed a swelling in the left side of the neck which followed immediately on scratching an "eczema" of the left ear. Within a few days the swelling extended downward, mesially, and into the right breast which became enlarged, tender, and reddened. With this extension there was a high fever, 104°F., with delirium for nearly twenty-four hours. The family physician diagnosed erysipelas. With poulticing, 3 small patches of epithelium sloughed off just above and mesial to the nipple, and for two weeks there was a sanguino-purulent discharge from these sinuses. The fever diminished but the breast remained greatly swollen, and was painful to the least motion. Except for anorexia there were no other symptoms. About five days before entry the upper part of the right breast enlarged rapidly, and a tender swelling appeared over the right clavicle, and extended across the front of the neck to the left side. The fever increased and the patient was brought to the hospital.

Examination on admission of the patient revealed an elderly, obese female lying quietly in bed, face flushed, breathing rapidly, eyes bright, mentally clear but obviously acutely ill. The right breast, normally large and pendulous, was swollen to nearly twice the size of the left breast, the swelling extending upward into both sides of the neck, posteriorly as far as the upper borders of the trapezeii. Over this whole area the skin was reddened, tense and hot. In the region of the nipple, were several small ulcerations filled with fibrin. Several glands were palpable in the left posterior triangle of the neck. Temperature 100.4°F.; Respiration 26; Pulse 100. Blood count: Hb 80 per cent; R. B. C. 3, 150,000; W. B. C. 7650; P. 82, L. 16, M. 2. The urine showed a slight trace of albumin.

In the operating room linear incisions were made in both infraclavicular regions from which large amounts of old blood and pus escaped. Also linear incisions were made in the right axillary line and right border of the breast from which large amounts of pus were evacuated. Soft rubber drains were inserted and the wounds left open. Culture from the wound grew staphylococcus aureus.

The temperature fluctuated between 99 and 103°F. The wounds drained copiously a sanguino-purulent discharge. The patient became drowsy after operation and took fluids only by hypodermoclysis. Blood culture on the sixth day gave no growth. Death occurred ten days after admission. Permission for autopsy could not be obtained.

According to Kaufman,[14] in infectious mastitis, pyogenic organisms invade the breast (1) through the nipple, (2) through the milk ducts, (3) alongside the milk ducts through the lymph channels but in rare cases a mastitis may occur (4) by metastasis in a pyemic, usually puerperal process, or in typhoid fever, or even from the thorax (empyema, caries). This case belongs in the last category as a lymphogenous metastasis from a focus in the left auricula, extending as an acute, diffuse inflammation of the skin and subcutaneous tissues, a true phlegmon. In situations where the skin is thin a phlegmon may simulate erysipelas in appearance, a fact which led to confusion and delay in this instance.

The mammary glands are of ectodermal origin and are regarded by most authorities as modified sweat glands;[15] this, together with the knowledge that the superficial lymphatic vessels of the anterior part of the neck freely anastamose with those below

the clavicle, and that the superficial vessels on both sides of the anterior thorax freely anastamose across the front of the sternum,[16] serves to explain the manner of extension of the infection in the case described.

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FUSION OF KNEE-JOINT

IN A CASE OF CHARCOT'S DISEASE*

Mather Cleveland, M.D.

NEW YORK

A FIFTY-ONE year old negro applied for treatment at the New York Orthopedic Dispensary in November, 1928. He had a swollen left knee and limited motion, but a little lateral instability. He had a positive Romberg's sign. Voluntary sensation in the leg decreased. The pupils were irregular and sluggish. The roentgenograph showed loss of substance of the internal table of the tibial head, with condensation and disorganization of the joint, and considerable effusion and detritus throughout the joint. The Wassermann reaction was 4 plus. *Diagnosis:* Charcot's disease of knee-joint.

The patient was admitted to Sea View Hospital, November 19, 1928. *Operation:* Fusion of knee-joint, Hibbs' technique. Spinal anesthesia. Spinal fluid showed 2 plus Wassermann reaction; joint fluid showed 4 plus Wassermann reaction. The tissue was reported as showing chronic hyperplastic arthritis, probably of syphilitic origin.

The leg was immobilized by a plaster-of-Paris spica for two months, and then a long leg circular plaster-of-Paris splint for four months. Fusion of the knee-joint was solid at six months, and the patient went home ten months after the operation.

He now walks well, the instability of the knee is gone, and he is pleased with the result. His last Wassermann test was still 4 plus, in spite of a good deal of antiluetic treatment. This is a very fortunate outcome, which cannot be expected in every case of Charcot's disease of the knee-joint.

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EDITORIAL

SPECIALISTS

WITH the birth of modern surgery medicine became a complex calling. In our father's time a medical student had to cover but four or five major subjects. Two years were deemed sufficient time to launch a full-fledged doctor of medicine upon the public. It might be said the worth of a physician was estimated by the size of his watch chain, the endless number of ingredients he incorporated in his prescriptions, and whether he kept one, two or three horses going. If we believe the stories told us by those who graduated about the time of our Civil War, then medicine was a dignified profession, hedged around with ethical fences, hairs were split on minor details and an operation was truly a major event, major to both patient and surgeon. Those days have gone and whether or not the profession was on a higher scale of culture than at the present time is a matter for endless debate getting one to no definite conclusion.

However, we have the present to consider. No man can pretend to know it all. If he becomes thoroughly grounded in a certain branch of medicine he has attained enviable heights. When he confines his work to a distinct part of medicine or surgery he becomes labelled a specialist. The true background of a specialist is composed of a number of years in general practice which has given him a solid foundation in the broad fundamentals.

The public has come to look to and recognize specialists. They (the public, know no man can be expert in many branches of his work. If the profession is to keep faith with the public it must see that all who profess to be specialists are in the true sense of the word expert in a particular field. What constitutes a special-

ist? It is hard to define. In a broad sense a specialist is one who has had an ample background in general medicine, and has been specially trained by competent teachers in the many subdivisions of a division of medicine, and from years of laboratory and clinical practice under competent supervision has attained a proficiency out of the ordinary. Taking a six weeks course in some distant institution in some special work, or going abroad and wandering from clinic to clinic for a few months does not make a specialist. There are no short cuts. The road is long and the work hard and the candidate must have a natural aptitude for his tasks.

And so it is a good sign that there has been organized and is functioning harmoniously the American Board of Obstetrics and Gynecology, the aim being to determine the competency of specialists in these fields. Recognized specialists became charter members and all others are admitted after passing a satisfactory examination. Those admitted to membership have issued to them a certificate stating the holder is thoroughly competent and skilled in obstetrics and gynecology. This is no new idea. The ophthalmologists, the otologists, and the laryngologists were the first to show the way.

The state does not define qualifications for a specialist. It grants the holder of the license the right to practice medicine and surgery in all its branches. Given one with an interneship of a year in a general hospital and a place to operate—who is to judge if that man is competent to open an abdomen or remove a tumor or attempt any major procedure? There is too much needless and poor surgery done by incompetent men who are surgeons merely because they have so labelled themselves.

Other branches of surgery should follow the trail made by these special boards. By proper methods the public should be made to look for and demand that a specialist have credentials at hand to substantiate his right to the title. When this happy state is arrived at a specialist will be truly a specialist, and a great step forward will have been made to gain and retain the confidence of the present-day incredulous public. T. S. W.

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"McBURNEY'S POINT"

CHARLES McBURNEY was born at Roxbury, Mass., on February 17, 1845. He came from a family of culture and wealth. Therefore, he was given the benefits of a thorough education. As a youth he attended private schools in Boston. From these he entered Harvard from which he graduated with his Bachelor of Arts degree, in 1866. Four years later he received his M.D. from the College of Physicians and Surgeons. McBurney served his surgical interneship at Bellevue Hospital. Following this he went abroad for two years and continued his studies.

Thus well equipped to begin practice he opened an office in New York City. His first appointment was that of Assistant Demonstrator of Anatomy at the College of Physicians and Surgeons (1873). The following year he was appointed Attending Surgeon to St. Luke's Hospital. In 1880 he became an Assistant Surgeon at Bellevue Hospital. Two years later he was a Lecturer on operative surgery at the College of Physicians and Surgeons. In 1886 he received the appointment of Consulting Surgeon in the Presbyterian Hospital, the New York Hospital, and the Hospital for the Ruptured and Crippled. In 1888 he was given the position which he held for twelve years, that of surgeon to the entire surgical division of Roosevelt Hospital.

For three years he was Vice-president of the New York Academy of Medicine. He was an honorary member of the Royal College of Surgeons (England), and an honorary member of the College of Physicians and Surgeons (Philadelphia).

Although he was a surgeon of outstanding ability, widely recognized as one of the leading operators of his time, his chief claim to fame rests on an article published in the *New York Medical Journal*,[1] entitled, "Experience with Early Operative Interference in Cases of Disease of the Vermiform Appendix." Associated with this was an article appearing in the *Transactions of the Medical Society of New York*, 1891, page 208, entitled, "Discussion on Appendicitis; Indications for Early Laparotomy." The source of the eponym, "McBurney's Point," now known to every freshman in a medical school, appeared in these papers. He made the point that his "point" was the most common site of the base of the appendix. Naturally, other investigators immediately undertook work to check the accuracy of this statement. Munro and Lanz disagreed and each, in turn, attempted to anatomically designate this "point," and so we have "Munro's point" and "Lanz's point," but these have fallen into disuse with time, except in certain localities. Murphy of Chicago, while admitting that McBurney was in error emphasized the diagnostic importance of tenderness over this "point." Thus, today nothing is more common than the expression, "tenderness over McBurney's point" in the physical examination of a potential or actual case of appendicitis.

McBurney did other writing and introduced new surgical methods and instruments. In 1894 he introduced the so-called McBurney incision for appendectomy.

McBurney, a many-sided man, loved the out-doors. In his youth he rowed; later in life he took up golf, was an expert shot and fisherman. In 1892 by a gift of Wm. J. Sims the first modern operating room was established for him at Roosevelt Hospital.

McBurney married Mary Weston in 1874. They had two sons and a daughter. His wife died in 1909. His health failing, McBurney retired in 1908. Following a hunting trip in Maine, he was attacked with cardiac disease and died at the home of his sister in Brookline, Mass., on November 7, 1913.

T. S. W.

[1] Vol. 50: 676, 1889.

CHARLES McBURNEY

[1845-1913]

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[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

SURGICAL AND NON-SURGICAL IMPRESSIONS FROM EUROPE*

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THE following is not a comprehensive description of a recently made surgical pilgrimage through European hospitals (the space limits do not allow such an extensive report) but merely an informal review of impressions and observations which in the humble opinion of the writer may interest the reader; in other words, an attempt was made not to imitate a painting of old masters, complete in every detail, but rather to give an impressionistic picture with a suggestion here and there.

The outstanding feature in the medical field all over Europe is the encroachment of compulsory insurance and state medicine upon private practice. The complaints of lack of patronage are loud and bitter, on the part of the independent practitioner, in almost all countries of Europe. Denmark may serve as an illustration of the menace of socialized medicine. In this country the adult population insured exceeded 41 per cent in 1922 and 64.8 per cent in 1927.

In England every physician to whom the writer had the opportunity to talk would always touch the subject which interests him vitally, the evils of medical socialism. Attention was called to the alarming increase of excessive claims for sickness benefit under the National Health Insurance Act in effect in England. Sickness benefit claims of married women have risen between 1921 and 1927 by 106 per cent and disability benefit claims by 159 per cent. Fourteen men in every 1000 claimed sickness benefit in 1921; 23 in 1927. Physicians are in the dilemma of becoming dishonest or losing patients if not sufficiently lenient. The fears of complaints by the patients exerts a harmful effect upon the morals of our English colleagues; the laxity of certification is spreading.

The proposal of the British Medical Association to provide a nation-wide medical service stirred various comments among the English physicians. The plan is not ripe enough to permit one to form any definite opinion.

As to the illegal practitioners, Christian scientists and chiropractors are not numerous and do not play any important rôle in England.

In London the writer started where every Britisher hopes to end: in Westminster Abbey, where among other celebrities, Hunter too is buried, a beautiful example of the homage England pays to great physicians. Another example of England's respect and appreciation of accomplishments in the medical field is the beautiful monument of Florence Nightingale in

* Submitted for publication October 14, 1930.

front of the Crimea Memorial in Waterloo Place, one of the most exclusive squares in London.

In the northwest corner of Trafalgar Square, one of the most popular places in London, not far from Nelson's column is a monument of Edyth Caldwell who gave her life for her country in the World War. There is a story that good women were once so rare in this vicinity that when one entered Trafalgar Square, Nelson, on the top of the column, lifted his hat and the lions surrounding the monument roared. No such demonstration happened when the writer was there.

Close by is the Royal College of Physicians occupying a beautiful building in one of the most important centers of London's life on the corner of Trafalgar Square and Pall Mall. The Royal College of Surgeons is located near Lincoln's Inn in a historical section of London. These few examples show that the medical profession in London enjoys a social prestige and prominence sometimes not so visible in our country.

It was thrilling to hear that Dr. Sloane's collection of the 18th century formed the nucleus of the British Museum.

Practically all the medical celebrities and magnates have their offices either on Hartley or Wimpole Street; the buildings occupied by the offices have a small but dignified façade and are two stories high. There are between one and five offices in each building, some of them located on the first and some on the second floor. Group practice is not popular in London.

The majority of confinements is still handled by midwives with excellent training; very few maternity cases go to the hospital, usually only if due to some abnormalities or pathology when they are referred by midwives to physicians for surgical interference.

The hospital situation is exceedingly interesting. The religious organizations manage only infirmaries, old people's homes, orphan asylums and similar institutions but not hospitals. The latter are in the majority of cases supported by the community, have a lay board of directors and depend entirely upon voluntary contributions. It was interesting to observe how such contributions are solicited. St. Bartholomew Hospital is in constant need of money and in order to raise it, it issues periodically a vast literature in form of pamphlets, circulars, postal cards, etc. A huge billboard placed on the roof of a building in Piccadilly Circus, the hub of London's traffic, says "Bart's never failed us—let us never fail Bart's." The hospital also resorts to invitations of the lay public to visit the operating rooms and unoccupied surgical wards in the just finished addition. Several nurses were encountered in various parts of the city collecting money for St. Thomas Hospital. A sign in the subway reads: "St. Thomas needs a penny a second." Garden parties frequently patronized and attended by Royalty are a popular means of raising money for hospitals. A "Living Poster" ball in aid of the Garrett Anderson Hospital was arranged in June. One of the loveliest groups in the pageant was the "Figure of Charity" with five little children clinging to her skirts. Lady Diana Cooper whose ethereal loveliness was enhanced by the severity of the nun's headdress was Charity. She is well remembered in the United States from her rôle in the "Miracle."

St. Bartholomew's Hospital is called the Mother Hospital of the English-speaking races and the cradle of British medical science. It was founded in 1123 by the Monk Rahere, formerly Henry I's court jester and occupies a part of an Augustinian priory. Henry VIII closed the hospital in order to save money, but finally was induced to reopen it; a stained glass window in the administration building shows him returning the charter. The ancient building has an indescribable charm; it from as striking contrast with the new surgical block which incorporates the latest improvements in scientific hospital construction. The corridors are heated

by steam tubes hidden in the walls. Every bed is equipped with radio ear phones. Each bed in the wards is screened and by means of washable curtains it can be transformed into a separate cubicle if so desired. There are fireplaces in wards creating a homelike atmosphere. The bedside tables have drawers which can be locked by the patient. The anesthetics are supplied through tubes from containers in the basement in order to avoid the danger of explosion. If the operating room which the Englishmen call "theater," is suddenly required for an operation, it can be warmed in five minutes by filtered air driven across special radiators by big fans. The operating room is completely bare except for an adjustable table and a short concrete pillar for the instruments needed for the operation. The instrument cupboard is outside and the observation gallery is set back in the wall and screened with glass. Set into the wall nearest the operating table are three panels for illumination of *x*-ray negatives, so that the surgeon may study the picture while he operates. There are day and night rest rooms for the friends of patients dangerously ill. The old administration building possesses two famous pictures by Hogarth; they alone are worth a trip to the hospital. A unique historical medical exhibit was arranged in June, 1930 in the new annex. The church across the street from the hospital is a shrine for lovers of architecture.

Another interesting institution is Guy's Hospital, built and endowed in the 17th century by Thomas Guy who made a fortune selling Bibles. John Keats, the famous poet who lived 1795 to 1821, acted as a "dresser" in this hospital.

In the Westminster Hospital Annex a "bomb room" for radium has been established. The apparatus for administration of radium is contained in this special room whose walls are lined with barium for protection in adjacent rooms. The arrangement of the apparatus permits directing the rays on two patients simultaneously.

It deserves notice that for centuries England has been taking a great pride in its hospitals and therefore prominent architects were commissioned to build new medical institutions. Sir Christopher Wren, one of the most famous English architects, who built St. Paul's Cathedral in London in the 17th century, Hampton Court, Greenwich Observatory and many other famous structures, is also responsible for the Chelsea Hospital in London.

It was surprising to hear that in many hospitals the operating schedule starts not in the morning but at 1:30 P.M. Ethyl chloride is being used extensively not only for local but also for general anesthesia for minor surgery. Mercurochrome is very little known. The use of picric acid is the routine preoperative preparation for the skin of the patient. Varicolored silk facilitates the work of the instrument nurse, various sizes being dyed in different shades.

In many older towns of England will be found semi-religious buildings of medieval date, in the form of hospitals, club houses and the like, that often possess an indescribable esthetic and historical charm. The writer had the opportunity to visit one of them, Leicester Hospital in Warwick, a beautiful quadrangular gabled building in black and white, originally a guild hall of the 15th century.

A bit of medical history in England may interest the reader. Barbers possessed from an early date a monopoly of practicing the art of surgery in the city of London and for a radius of 7 miles. In 1461 they were incorporated as one of the City Liveries Companies. In the reign of Henry VIII they were styled "Barbers and Surgeons." The surgeons were incorporated in a separate body in 1741. Apothecaries (drug stores) were originally incorporated with the Grocer's Company in 1606.

From England the way led to Holland. In the Hague Rembrandt's painting, "The lecture of Anatomy by Nicholas Tulp" was greatly admired. It gives evidence of the artist's strikingly well developed

power of observation. In this painting Rembrandt has portrayed the tendons of the flexor digitorum profundus perforating those of the more superficial flexor digitorum sublimis. In this picture the artist also demonstrated his great talent in the use of chiaroscuro or contrast of light and shade.

The adjoining country of Belgium installed telephones along the main highways for first aid at intervals of one kilometer (0.6 of a mile) connected day and night with first aid stations charged to bring to tourists within the shortest time possible, the aid they need whether on account of accident or sickness.

The next country to visit was Germany. The scope of the National Insurance can be imagined when you learn that 6,300,000 received doles in 1929. It is financed by the government and taxpayers. Health, accident, invalidism, old age and unemployment insurance are in effect. The unemployment insurance gets 3.5 per cent of workmen's pay contributed by employer and worker. The health insurance fee is 6 per cent of the worker's pay, one-third of which is paid by the employer. Of twenty-two millions insured 11.6 per cent underwent medical treatment in one year. For accident insurance the employer pays 2 per cent of his worker's pay. The increase of sickness claims due to the Compulsory Sickness Insurance in 1929 was 70 per cent over 1924.

Regarding the professional fees a few examples will be sufficient to form an idea how underpaid the German physician is. For setting a fracture he is paid 15 marks (1 mark equals approximately 25 cents) and he is entitled to charge 60 pfennings (15 cents) per each day of after-treatment. For an abdominal operation such as appendectomy he receives the fee of 50 marks and 60 pfennings per day. For a confinement he is paid 50 marks. Of course *x*-ray pictures and anesthetics are paid for extra; also an additional small fee is paid for distance to the patient's home. A question was asked, what prevents the patient from consulting the university professors even in case of trivial ailments as long as the insurance company pays for it. The explanation was given that the patients frequently dislike to consult the professors because instead of getting personal attention they are turned over to the assistants. It is by no means a rare occurrence for the sisters who manage the hospital to appropriate the professor's fees for the general hospital fund. Positions in hospitals being highly desirable on account of the wealth of material, the physicians are inclined to overlook such "mistakes."

It was edifying to learn that group practice is forbidden by the Krankenkassen (sick benefit associations) because it creates an unfair competition.

Another interesting feature is the establishment in Prussia of an occupational tax levied on physicians. The way the problem of abortions is handled in Germany is very instructive. No fees whatsoever may be charged for a curettage performed on account of an incomplete abortion. Therefore such patients are usually directed by the physicians to charity institutions. This rule is an attempt to curtail illegal abortions performed by physicians.

It was noted that the majority of German Hospitals have *x*-ray departments which are larger and better equipped than ours; the surgeons are better trained in the interpretation of radiograms and are usually present at fluoroscopic examinations instead of depending upon the written report. Instead of the deplorable indifferent attitude or half-hearted support we find a great interest for radiology among the surgeons.

In Germany as well as in England ethyl chloride is extensively used for general anesthesia and is not regarded as dangerous if used a few minutes only. The new anesthetic avertin enjoys an enormous and steadily-increasing popularity. As it is relatively little known in the States a few words may be said about it.[1]

[1] The reader is referred to the July, 1930, issue of The American Journal of Surgery, Ed.

Avertin or tribromethanol synthetized in 1923 by Willstaetter and Duisberg and investigated pharmacologically by Eichholtz in 1926 has been used in over 150,000 cases reported in the current literature; it seems that we have acquired in it a valuable new anesthetic. It is employed in the form of a 2½ per cent aqueous solution of avertin fluid and the amount so calculated that the dosage is 100 mg. per kilogram of body weight. The solution is tested before it is administered by adding to 5 c.c. of avertin solution a few drops of 1:1000 aqueous solution of Congo-red; the resulting color should be a clear orange-red, without any violet or bluish tint, the latter indicating decomposition. Thirty minutes before operation the solution is introduced into the rectum. It does not produce local irritation unlike other rectal anesthetics. In from ten to fifteen minutes after the injection sleep occurs without a preliminary stage of excitement. In the majority of cases there is no nausea after the operation; another welcome feature is the postoperative amnesia. The patient has no recollection of anything that happened. A supplemental anesthesia, whether general or local, is required in about 75 per cent of cases, but the quantity of inhalation anesthetic is substantially reduced. The outstanding feature of this remarkable agent is the production of unconsciousness without the patient's being aware that an anesthetic is being given. The preoperative anxiety and apprehension of the surgical patient are thus eliminated. It is applicable in pediatric practice. The main contraindications are severe organic diseases of liver and kidneys, acidosis, advanced pulmonary tuberculosis and ulcerative processes of rectum and colon; also obese, debilitated and elderly patients. It is especially well tolerated in hyperthyroidism and therefore extensively used in operations for toxic goiter. It is an excellent basic anesthesia, that is a primary means of inducing unconsciousness, to be supplemented if necessary by some other general spinal or local anesthesia. It represents a valuable contribution in the field of general anesthesia and deserves special attention in cases of exophthalmic goiter, in pediatric and obstetrical cases.

The administration of inhalation of carbon dioxide at the termination of general anesthesia is much more popular in Europe than in the United States. Recently, Henderson recapitulated the benefits of inhalation of carbon dioxide; it effects a restoration of the alkali carbonates in the blood and carbon dioxide contents of the blood. The deep breathing induced by inhalation of carbon dioxide is effective in preventing and overcoming postoperative pneumonia which sometimes develops from atelectasis.

It has been gratifying to learn that Hamburg has named a street after the late famous dermatologist, Professor Paul Unna.

In Bonn in the University Clinic of Professor von Redwitz avertin is being used in every goiter operation. In gastric ulcers resection is given preference to gastroenterostomy.

In Heidelberg the same nurse has been in charge of the operating room for twenty-one years. Such incidents explain why team work in European clinics is so excellent. In the institute for Cancer Research in Heidelberg Professor R. Werner reported favorable results from autohemotherapy, i.e., injection of the patient's own blood around the tumors in the treatment of superficial cancers.

In Berlin in the University Clinic Professor Bier uses blue operating sheets claiming that they do not hurt the eyes as much as the white ones. This master surgeon possesses no dramatic quality but is careful and conscientious in his surgical technique. Bassini's method is the operation of choice for herniotomies. Avertin is being used extensively.

Professor Sauerbruch in the Charité has an enormous operating room; the floor is blue, the walls are tiled in pleasing gray and blue hues. In his clinic as well as in the majority of other German hospitals,

rubber aprons and wide rubber shoes are worn by the surgeon and his assistants at every operation. In exophthalmic goiter and in pediatric practice, 1 per cent thymol spiritus colored with eosine is used instead of iodine for skin disinfection. Sauerbruch uses avertin extensively. Silk is preserved in a mixture of 1 per cent camphor oil and 96 per cent alcohol. Catgut is kept in the following solution: iodi puri 1.0; paraffini liquidi 30.0; benzini, 1000.0. Mastisol is used for dressings instead of adhesive plaster or collodium. This mixture is prepared in the following manner:

Mastix..... 20.0 (1 heaping tablespoon)
Chloroform.. 50.0
Linseed oil... gtt xx

Kirschner's pin is very popular for extension in fractures of long bones. After the operation, the patient's bed is wheeled into the operating room and the patient transferred from the table directly to his bed. In the surgical clinic of the Charitè each floor has balconies occupying the entire length of the building, thus giving the patients the benefit of fresh air.

In Tempelhofer Feld which is the largest flying field in Europe, the writer witnessed army exercises in transportation of wounded soldiers by aeroplanes.

Nearby is St. Joseph's Hospital, the last work in hospital construction. Each floor has open verandas communicating with every room so that the patient can be shifted there in his bed without any difficulty; the courtyards are surrounded by arched cloisters and have beautiful flower beds. There are flower boxes in front of every window. In the operating room a high stool with a top in form of a bicycle seat was noted. It is customary in Germany for the surgeon to sit during prolonged operations, a habit worth while imitating as it prevents formation of varicose veins and physical strain.

In Dresden in the new children's hospital every room has a door leading to a terrace; it exemplifies the great attention paid in Germany to fresh air in postoperative treatment. The International Hygienic Exposition was visited. It had been advertised on huge billboards all over Europe. One interesting feature was a stage which has been made to serve hygienic teaching. A drama entitled "The Tragedy of the Physician" enlightens the people as to the nature and treatment of cancer. The international health service of the Hygiene Museum has prepared a traveling exhibit installed in an autobus which will be shown in rural districts. Models, lantern slides, charts and films will be utilized. A large tent is carried for the protection of the exhibit and the audience.

In Munich the palatial hospital in Schwabingen was visited. Although the pavilions are twenty years old the immaculate cleanliness creates the impression that they are brand new. The courts are surrounded by arched corridors and filled with linden trees and flowers. This institution as well as St. Joseph's Hospital in Tempelhof in Berlin should not be omitted by any person who is interested in hospital construction.

In Oberammergau, where the famous passion plays are played, the children's hospital is called Hansel and Gretel House; the front of it is decorated with paintings representing scenes in the charming fairy tale.

From Germany the way led to Prague. A visit to this old city is a delight filled with interest. The people are charming and most cordial. Prague has two universities: Czecho-Slovak and German. Professor Jirasek is head of the department of surgery of the Czecho-Slovak University. He speaks English fluently. While watching his operations one is impressed with the swiftness and gentleness which bespeaks a perfect knowledge of anatomy, pathology and a mastery of technique. The majority of herniotomies are performed under spinal anesthesia. The skin is sutured with curved needles. The surgeon sits while performing the operation. Kirschner's pin is in use for treatment of fractures of long bones.

In comparison with many of our hospitals much greater attention is paid to after-treatment of fractures; the clinic is equipped with devices for baking, Zander's apparatus, quartz lamps, etc. Jirasek does not inject one varicose vein at a time but hospitalizes the patient, injects all the veins at one time and ligates the saphenous vein; he uses either glucose solution or sodium chloride. For gastroenterostomy he uses interrupted stitches; silk is the sewing material.

Professor Schloffer is the head of the department of surgery of the German University in Prague; he also speaks English. An opinion of the wealth of material can be formed when one learns that an average of 20,000 patients a year visits the dispensary of his clinic. Spinal anesthesia and avertin are the anesthetics of choice in the majority of operations. He favors resection of stomach in gastric ulcers. Mastisol mentioned before as being used by Sauerbruch is also popular for dressings in Schloffer's clinic. He also uses Kirschner's pin in treatment of fractures.

From Czecho-Slovakia the pilgrimage brought the writer to Vienna. It was pleasing to hear that Vienna erected a monument to the late Professor Clemens Pirquet. The most amazing sights in Vienna are the new houses for people of small means. The building program of the municipality has provided the city with 60,000 new dwellings. Shabby slums have been replaced by huge structures admitting light and fresh air in abundance and providing standards of order and cleanliness. The rent for an apartment consisting of four rooms is $3.00 per month and includes gas and electric light. A separate building usually located in the center of a large courtyard contains a laundry and a bathing establishment with bathtubs, showers and swimming pool; also a kindergarten and a library. The laundry has the newest equipment including electric washing machines, wringers, mangles and drying rooms. The use of laundry and baths is either free or a ridiculously low nominal fee is charged for it. In some of these dwellings a central kitchen provides meals for all who wish to avail themselves of its service. This successful attempt of the Vienna municipality to solve the housing problem excites deep admiration.

The surgical clinic of Eiselsberg in the Allgemeines Krankenhaus does not look attractive from the outside but the wealth of material and the reputation of the staff are known to the medical profession all over the world. Only a few points will be mentioned as it is impossible in a short description to give a complete report of all the impressions. The bottoms of the pails in the operating room are provided with rubber discs in order to prevent noise. The sewing material is wound on colored reels facilitating the selection of the proper number by the nurse. Mitchell's clips are being used extensively. A drain for thyroidectomies is made up out of a few braided wool strands. All the operations for toxic goiter are performed under avertin, eventually supplemented by nitrous oxide or procaine. Splanchnic anesthesia and Pitkin's method of spinal anesthesia are being used in abdominal surgery. However, local anesthesia is much more popular than in the majority of the American hospitals; for example, the writer witnessed a resection of the upper jaw for cancer under excellent local anesthesia. In callous gastric ulcers resection is the operation of choice. Mastisol is being used for dressings. In gastroenterostomy the suturing is made with curved needles; catgut is being used for the mucosa and silk for the other layers. After the operation the patient is transferred not to a cart but to his own bed rolled into the operating room.

After Austria, Italy was visited. In Rome, the Policlinic, a combination of very attractive modern buildings affiliated with the university, occupies several blocks. The distinguished Italian surgeon Bastianelli retired on account of age, and Professor Allessandro became the director

of the surgical department. The clinic is one of the relatively few hospitals in Europe where ethylene is being used for anesthesia. In the preparation of the surgeon's hands for operation scrubbing with soap and water is omitted entirely and substituted by the use of 70 per cent alcohol for ten minutes; after that, the tips of the fingers are dipped into tincture of iodine.

In the basement of the Capucine Church in Rome, an odd collection of bones was visited; it occupies several rooms. The monks arranged the bones of their deceased brethren on the walls and ceilings in fantastic manner. Even the chandeliers are made out of real bones.

In Florence a foundling hospital was created in the 14th century; the generous philanthropist not only gave sufficient funds to build the hospital but endowed it with such a great sum that the institution still manages to be self-supporting. Famous medallions by Andrea della Robbia, representing bambinos, i.e., infants in various poses, decorate the exterior walls of this hospital.

The last stop of the tour was Paris. After Professor Tuffier, one of the most prominent French surgeons, expired, his chair of surgery was offered and accepted by Professor Cuneo. Hôtel Dieu, one of the oldest hospitals in Paris, affiliated with the medical school, occupies an enormous quadrangular building with an open court surrounded by charming arcaded galleries. Bassini's operation is the method of choice for herniotomies. In abdominal surgery, chloroform is still occasionally used for anesthesia. However, it has been replaced largely by spinal anesthesia. Otherwise nothing was noted that differs greatly from our technique.

If it is permissible to summarize the impressions and emphasize the points which made the greatest impression upon the writer, the following may be said.

1. A general apprehension among the medical fraternity in Europe on account of state medicine. A growing dissatisfaction with the conditions created by the compulsory health insurance.
2. Excellent surgical team work, explainable by the fact that the surgeon, his assistants and nurses work together for many years.
3. Extensive use of the new anesthetic avertin.
4. Popularity of Kirschner's pin in the treatment of fractures of long bones.
5. Emphasis laid upon fresh air in postoperative management of surgical patients.
6. Close cooperation between surgeons and radiologists; excellent equipment of roentgenological laboratories and good training of surgeons in interpretations of radiograms.

BOOK REVIEWS

TAIT MCKENZIE. A Sculptor of Youth. By Christopher Hussey. Phila., J. B. Lippincott Co., 1930.

Leonardo da Vinci was primarily an artist and sculptor. His interest in anatomy was developed as an auxillary to his artistic work. McKenzie's technical training reverses that of Leonardo da Vinci in that it was that of an anatomist and his artistic development had as a background his knowledge of human anatomy and remarkable opportunities to study the human form in action as Director of Physical Education at McGill and the University of Pennsylvania. As Hussey says, "Probably no man filled with the aesthetic impulse has, since the days of the Greeks, seen pass before his eyes so long and varied a procession of men in the nude as he has during the physical examinations that he has conducted for the last thirty years." Hussey divides McKenzie's artistic career into two parts; the first deals with the years in which he was almost entirely

occupied with the sculpture of the athletic form in action. The second part takes up his work since the Great War, much of it consisting of War Memorials but including also much valuable work on other lines, especially as influenced by the Great War. The division is a good one because in the nature of events that historic episode marks a sharp differentiation in its characteristics.

The son of a Scotch minister of a small parish in Canada, McKenzie after completing his school years entered McGill at the age of eighteen and worked his way through the subsequent years of his university life, graduating in medicine in 1892. When he began his studies at McGill his lack of physical development barred his way to participation in athletics. This handicap he overcame by serious work at self-development until by the end of his second year he had won the All-round Gymnastic Championship and before graduating played on the football team and won the Inter-Collegiate High Jump Championship. The work which he did in the perfection of his own physical development was to prove of great value in his subsequent labors towards the regeneration of others.

In 1891 McKenzie was appointed assistant instructor in the gymnasium at McGill, and the following year was given entire charge of physical education at the University. In 1894 the post of Medical Director of Physical Training was created and the position given to him. A few years later he became Demonstrator and Lecturer on Anatomy in the Medical School. All of the work of these years moulded his artistic development. In 1900 McKenzie first turned his attention to modelling and shortly afterwards brought forth his first notable artistic achievement, the four masks of the face showing its expression in Effort, Breathlessness, Fatigue and Exhaustion. Following this initial success McKenzie began his work as a sculptor in the round and produced "The Sprinter," which was hailed with acclaim by the artistic world, and at once established his position in sculpture. It is impossible to describe McKenzie's continuous series of triumphs in the depiction of the athletic form both in various forms of action and in repose. The statues and medals of the years which followed have most of them been reproduced in such numbers as to render the majority familiar to all.

In 1904 McKenzie accepted the position of Professor of Physical Education in the University of Pennsylvania which he has held until the present year. In Philadelphia there may be seen several notable examples of his work in another field than that of athletics, statues such as those of Benjamin Franklin and Dr. Edgar Fahs Smith.

With the Great War came new opportunities. McKenzie got leave of absence from the University and going over to England received a commission as a lieutenant in the R.A.M.C. It was not long before his special gifts were recognized and he was put on the staff and assigned to the special duty of organizing methods for improving the physical condition of recruits and giving remedial training to men who had been rendered unfit during army service. Naturally in a book dealing with the artistic aspects of his life McKenzie's invaluable army service is not given the extended attention which it merits. He was later transferred to Canada for the same kind of duty, and when the United States entered the War his services were utilized by its government. During his army service McKenzie came in close contact with many new aspects of life and in 1915 he modelled the figure of a Scotch soldier "Blighty" which has won well-deserved popularity. This was the first of the war sculptures and it has been followed by many. In England, Scotland, Canada and the United States are many striking memorials in all of which McKenzie manifests the depth of feeling, catholicity of interest and fine instinct which renders them of such wide appeal. We cannot attempt to enumerate them in the space of a review. Hussey has studied them and the reproductions in his pages bring them vividly before us.

This book is a splendid tribute not only to the artist but to the man who is its subject. It is given to few nowadays to touch life and achieve distinction in so many aspects. Our profession may well be proud of the achievements of one who while perseveringly attaining distinction by his distinctly professional work has won for himself immortal fame as one of the most eminent sculptors of his day. Mr. Hussey's book is delightfully written and copiously illustrated with excellent reproductions of McKenzie's work.

DIAGNOSTICS URGENTS. By H. Mondor. Paris, Masson et Cie, 1930.

One of the most important problems that faces the practitioner of medicine from time to time is the problem of the so-called acute abdomen. What is going on back of that tender, rigid abdominal wall, and when should the patient be operated on? Will it be safe to watch for a few hours with the hope of making a better diagnosis? It is interesting to see that a volume of over 800 pages can be written on this subject alone. The book is well and interestingly written. It is well illustrated and it might with advantage be added to the library of every surgeon who can read French. It is a book which might well be translated into English. It appears to have been written by a man who has really had some experience and who personally knows something about his subject.

ANAESTHESIA AND ANAESTHETICS. By F. S. Rood, M.B., B.S., and H. N. Webber, M.A., B.CHIR. 277 pp., 56 illus., N. Y., William Wood & Co., 1929.

To those who are curious to compare our methods of anesthesia with those in vogue in University College Hospital, London, this book is recommended. Our accomplishments in general narcosis, as well as in regional, including subarachnoid block (spinal anesthesia), have been so rapid and varied, that few nations have been able to keep pace with the progress made in the United States, in less than a decade.

GENERATIONS OF ADAM. By A. L. Wolbarst, 355 pp., N. Y., Newland Press, 1930.

Here is an unusual book, i.e., a book about sex written without reference to the theological or moral aspect of the subject. True enough considerable discussion of both is present as explaining the false attitude of the general public to the important question which lies at the bottom of all life.

However sensibly and naturally the subject of sex may be dealt with by primitive people, the fact remains that in most of the so-called great civilizations the question has been unmercifully distorted both by so-called moralists and by the theologians. The present-day attitude of most American people is that sex and all reference to it is "dirty." Prominent Senators work themselves up into a frothy rage over books dealing frankly with the subject and most such books are on an *index expurgatorius librorum prohibitorum* and are not allowed free entry through the chaste parts of the country, albeit all of them may be bought freely in towns where there is more than one bookstore.

It is, therefore, refreshing to review a book in which the question of the relations of the two sexes is discussed from a biological viewpoint or as it really is rather than from that of the people who would like to have it as they think it should be. The author has done a good piece of work and all those interested, such as teachers, parents and social workers, would do well to read it, while members of all legislative bodies should not fail to do so.

It takes courage to put a book like this one out in "moral" America, and it will not be strange if the reformers and censors get after it, which would, of course, be just the advertising that it requires. A book as good as this one deserves widespread publicity and a brush with the vice hounds would help it a lot.

J. R.

DAS ULCUSPROBLEM IM LICHTE MODERNER RÖNTGENFORSCHUNG. By Priv.-Doz. Dr. H. U. Albrecht. Leipzig, Georg Thieme. 1930.

Dr. Albrecht has made an interesting statistical analysis of some of the problems of gastric and duodenal ulcer. A few years ago the Germans thought we, in America, were all wrong in our conviction that duodenal ulcers are much more common than gastric. It is interesting to see now that at least in Frankfort they are finding 5.8 duodenal to one gastric lesion.

The part of this book which interested the reviewer most was the discussion of gastritis. Albrecht uses the beautiful technique of Berg in which small amounts of the thick suspension of barium are put into the stomach. The films so obtained are beautiful and show a wealth of detail. Some of them show a thickening of the folds of the mucous membrane which probably has significance. The book deserves a place in the library of every earnest roentgenologist and gastroenterologist.

PRINCIPLES OF PREOPERATIVE & POSTOPERATIVE TREATMENT

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CONTENTS

[This Number]

	PAGE
CHAPTER III. The General Postoperative Care of the Average "Good Risk" Laparotomy Patient.	377
CHAPTER IV. Shock and Collapse.	413

[Previously Issued January, 1931]

INTRODUCTION	147
CHAPTER I. General Principles Underlying Rational Preoperative Treatment	159
CHAPTER II. The Preoperative Treatment of the Average "Good Risk" Surgical Patient	199

CONTENTS OF CHAPTER III

A. J. S. PAGE

I. Postoperative care before the removal of the patient from the operating table . . . 377
  A. Early toilet of the mouth and throat . . . 377
  B. Gastric lavage . . . 379
    1. Special indications for lavage . . . 379
    2. Technique of lavage . . . 381
  C. Change of garments . . . 385
II. Transportation of the patient from the operating room . . . 385
III. Reception of the patient in his bed . . . 388
IV. Care of the patient in bed . . . 389
  A. The administration of morphine . . . 389
  B. Postoperative administration of fluids . . . 392
  C. Postoperative position of the patient in bed . . . 395
V. Postoperative backache . . . 402
VI. Postoperative distention . . . 403
VII. Postoperative administration of food . . . 404
VIII. The use of cathartics following abdominal operations . . . 406
IX. Getting up from bed . . . 406
References . . . 411

PRINCIPLES OF PREOPERATIVE & POSTOPERATIVE TREATMENT

Chapter III

THE GENERAL POSTOPERATIVE CARE OF THE AVERAGE "GOOD RISK" LAPAROTOMY PATIENT

The immediate care of the postoperative case naturally concerns itself with the removal of the patient from the operating table and his return to bed in the ward or the room to which he has been assigned. It is assumed that the operative procedure is not complete until the dressing of the operative wound has been performed and the operating surgeon has indicated that the surgical seance as such is at an end.

Usually the patient is, of course, still either completely or partially under the influence of the anesthetic agent used during the course of the operation, whether local or general, and is in no condition to take care of himself.

The operative wound from this time forward should, in all procedures involving the manipulation of the patient, be treated with the utmost respect. When lifting, turning, or otherwise moving the patient stresses and strains on the suture-line should be scrupulously avoided.

1. Postoperative Care before the Removal of the Patient from the Operating Table

a. Early Toilet of the Mouth and Throat: The first consideration which arises in connection with the earliest care of the case involves attention to the respiratory and upper intestinal tract. Such cases as have been or are still under the influence of a general anesthetic require immediate care of the mouth and throat aimed at the mechanical removal of masses of foreign material which may have accumulated therein. The irritating influence of ether vapor makes itself felt in excess

formation of mucus and saliva, and frequently considerable conglomerations of such material, sometimes mixed with vomitus, become lodged under and around the tongue and between the jaws and the cheeks. If this material be not gently swabbed away, the swallowing reflex being still in abeyance, aspiration of the mass, or parts of it, may ensue, and the development of respiratory infection be thus favored. Probably the aspiration of some infected material in this manner during the entire course of the anesthetic period can hardly be avoided, and the relative infrequency with which pulmonary infections, which can truly be called aspiration pneumonia, develop postoperatively is an indication of the natural resistance to such infection normally present. In case the patient has vomited during the course of the operative procedure or begins to do so during the period of beginning return to consciousness there is an especial indication for care in connection with the mouth and pharynx, the removal of vomitus.

The removal of mucoid secretions or vomitus which have already found their way into the lower respiratory tract is not so simple a matter. Cases may frequently present urgent indications for such removal, however, as evidenced by considerable cyanosis, hyperpnea, and coarse tracheal and bronchial râles. A method which has proved of value, especially in cases in which the cough reflex is not in abeyance, is the treatment by postural drainage, a method which is commonly practiced in connection with the drainage of lung abscesses and bronchiectases.

The head and shoulders of the patient are gradually lowered, or, what amounts to the same thing, the feet are gradually lifted, until there is a considerable inclination of the body toward the head; the latter is then turned to one side, and the patient, if conscious, is encouraged to cough. Five minutes in such a position will usually prove of remarkable value in ridding the lower respiratory tract of accumulations of fluid and mucus.

In the severer cases several repetitions of this procedure at intervals of two or three hours are indicated after the patient has been returned to bed.

B. GASTRIC LAVAGE: The advisability of performing gastric lavage should now be considered. Most of the excess secretions of the upper respiratory tract resulting from the action of the anesthetic, and also vomitus, are either expelled from the mouth or are swallowed into the stomach. The presence within the lumen of the stomach of such material is undesirable from the point of view of bulk, from the point of view of the nature of the substance itself, and from the point of view of its anesthetic vapor content. Accordingly, many surgeons believe that a prophylactic cleansing of the stomach should be made a routine matter at least in cases of general anesthesia and habitually practice it as soon as the immediate toilet of the oral cavity has been completed. These authorities believe that thereby postoperative vomiting is minimized because the irritative action of the stomach contents is obviated.

In cases in which gastric lavage is practiced in accordance with the theoretical considerations large quantities of more or less tenacious, stringy, mucoid material, laden with the vapors of the anesthetic agent, are commonly recovered. The routine performance of gastric lavage, however, is not by any means universally practiced.

1. *Special Indications for Lavage:* There are, nevertheless, three different types of cases in which for relatively obvious mechanical reasons the institution of gastric lavage may be particularly indicated.

1. The cases in which preoperative treatment has been inadequate.

2. The cases in which inhalation anesthesia has been induced or maintained with difficulty, and the patient has coughed, struggled, choked, and vomited.

3. The cases in which the stomach or upper intestinal tract has either been obstructed preoperatively or has been the object of direct or indirect surgical attack during the operation.

In the first type of case lavage is advisable particularly in those cases in which food has been given only a short time

before operation and the gastrointestinal tract is, therefore, more or less burdened with the products of incomplete digestion. It must be remembered that in such cases during the administration of most anesthetics a condition of reverse peristalsis is prone to occur in the upper small intestine with regurgitation of succus entericus into the stomach, so that even though the stomach was previously empty, it becomes filled again; furthermore, subsequent to the operative procedure a relatively long period of intestinal quiescence ensues, due to paralysis of intestinal movements, especially in those cases in which the abdomen has been opened, and intra-abdominal trauma has been considerable. Material regurgitated in the manner described, therefore, tends to remain for long periods of time within the stomach unless mechanically removed therefrom, putrefactive changes tend to produce distension, and absorption of the products of putrefaction probably induce a mild toxemia not unlike that found in intestinal obstruction.

In cases of the second type, i.e., those undergoing difficult inhalation anesthesia, salivation, excess mucus secretion, and vomiting tend to be at a maximum, and saliva mixed with mucus and laden with ether vapor is swallowed in relatively large amounts. Such material is highly irritating to the gastric mucous membrane, and because of the interoperative and postoperative intestinal quiescence previously mentioned tends to undergo putrefactive changes.

In cases of the third type, i.e., preoperative obstruction or trauma in and about the stomach at the time of operation, the presence of undigested food in the former case and blood in the latter are of obvious origin. The fact that the stomach has been opened during the course of an operative procedure is no contraindication to immediate postoperative lavage, provided only that the manipulations incident thereto be performed with reasonable gentleness and a soft and flexible stomach tube be used. The modern technique of intestinal suturing should result in the immediate production of a suture line at least one-third as strong as the unbroken surface of

the organ, and under these circumstances perforation of the viscus with the stomach tube becomes a source of no particular anxiety. It must be remembered in this connection, however, that for a period of about three days postoperatively the suture-line becomes progressively weaker and weaker so that perforation becomes, during this time, a progressively increasing danger. As the result of operations on the stomach there is almost inevitably a considerable extravasation of blood into the lumen of the stomach either as a result of actual hemorrhage at the time the incision itself is being produced or later as cumulative capillary oozing from the wound edges. The accumulation of this bloody exudate combined with the outpouring of gastric juices in response to its presence in the stomach produces a weight and bulk of material which is undesirable and at the same time is very likely to produce peristalsis and frequently active vomiting as well. Plainly in such cases there is an indication for the performance of gastric lavage, an indication which is not present in the average case.

2. *Technique of Gastric Lavage:* The technique of gastric lavage is not difficult and the amount of time consumed by the procedure is not inordinate.

The position of the patient during the performance of lavage is of some moment. Retching and gagging may occur if the patient is not thoroughly anesthetized, and in the horizontal position inspiration of foreign material into the trachea and bronchi becomes a danger. The possibility of this occurrence is minimized by lowering the patient's head. In the performance of lavage a mouth gag is first introduced if the patient is unconscious: a fairly large stomach tube well lubricated with glycerine or one of the special water-soluble jellies prepared for lubricating purposes is introduced well down into the stomach, i.e., a distance, in the average case, somewhat more than 15 in. from the incisor teeth, care being taken that the tube is actually introduced into the esophagus and not into the trachea, and about ½ pt. of warm water is introduced through a funnel attached to the free end of the tube.

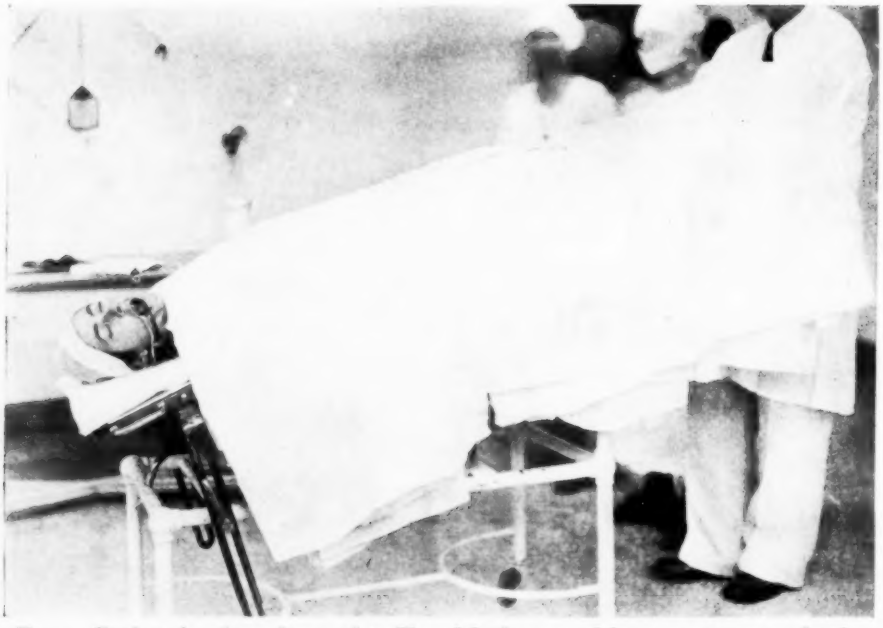

FIG. 3. Patient has been lowered to Trendelenburg position to prevent aspiration of any material which may be regurgitated during lavage; patient's head has been turned to side and mouth gag has been inserted to hold jaws apart.

FIG. 4. Stomach tube which is of fairly good size is being introduced through fauces along finger as guide.

FIG. 5. Tip of tube has been introduced for distance of about 15 in., and warm sodium bicarbonate solution is being poured into funnel of tube at free end.

FIG. 6. Funnel of tube has been depressed, thus instituting siphonage action; contents of stomach being received in a bucket. Lavage will be repeated until only clear solution is recovered.

FIGS. 3, 4, 5, 6. Performance of postoperative gastric lavage on the unconscious patient before removal from operating table.

Just previous to the escape of the last of this water from the funnel, the latter is quickly lowered in order to institute a siphonage action, and the contents of the stomach are allowed to escape into a suitable waste receptacle held under the funnel (Figs. 3–6). Only a small amount of water is introduced at the first washing because one has no way of determining accurately the amount of gastric contents already present in the stomach, and one must avoid undue distension of the viscus. As soon as the siphon action from the first washing has stopped additional fluid to the amount of a pint or more is introduced in the same manner as previously, and the process of withdrawal is repeated. This process is repeated again and again until the fluid returns clear. Usually the amount and character of the washings of a stomach as thus obtained is a revelation to one seeing them for the first time, and serve to convince many skeptical observers of the possible value of the procedure as a routine manipulation. The addition of a small amount of sodium bicarbonate to the water used in lavage is of value in partially liquefying and loosening deposits of mucus that may be present, but plain water serves the purpose fairly well, and the possibility of increasing an already present condition of alkalosis should be borne in mind, even though such an occurrence would not require very serious consideration, at least in the average case. The temperature and amount of water or bicarbonate solution introduced are of importance, since the patient is usually unconscious and is in no condition to complain either of excessive degrees of temperature, or of overdistension. A temperature of approximately 110° F. is not excessive, and the addition of heat in this manner serves in a minor way to maintain body temperature, which may be subnormal. The question as to whether some of the solution should be permanently left in the stomach after thorough lavage is one concerning which there may be some difference of opinion; in the majority of cases this is doubtless a matter of relative indifference, though the possible augmentation of an alkalosis should again be considered in

those cases in which sodium bicarbonate has been added to the wash-water.

c. Change of Garments: The toilet of the mouth, throat, and stomach being complete, attention is turned to the preparations incident to the removal of the patient from the operating table. Many operative procedures unavoidably soil the patient's clothing with hemorrhagic or other fluids; vomitus or occasionally other natural body fluids, and especially sweat, may have so soiled the clothing as to render it unfit for further use, and the legitimate time for making the change from such garments to warm, clean, and dry ones is the earliest possible moment, i.e., while the patient is being transferred to the carriage which is to transport him back to bed or to the recovery room. Washing or sponging of soiled body surfaces should, of course, be performed in conjunction with the change of clothing. Haste in cleansing the soiled surfaces of the body, adjusting the new and clean clothing, bathing of the face, and getting the patient out of the operating room to make room for another case is an admission of inefficiency on the part of the operating room force, the surgeon, or both. Even though the former are willing to tolerate such a situation the surgeon should not be, and if there is a legitimate reason for delay in making room for his continued activity the surgeon should be the first to insist that his own personal convenience be ignored.

II. Transportation of the Patient from the Operating Room

The conveying to, and the adjustment of, the patient on the movable transporting carriage which is to remove him from the operating room should be a matter of some concern; usually the patient is unconscious, and rough handling may result in actual bodily harm appreciated either immediately or in the form of postoperative complications later. The unconscious patient is unable to release his arms from under his body if they are allowed to become pinned thus, and he cannot

pull up an arm or a leg that has carelessly been allowed to hang over the edge of the carriage; neither is he in a position to defend projecting parts of his body against sharp edges and corners as he is wheeled out of the operating room and perhaps a considerable distance farther through the corridors. To the end that pressure paralysis, bruises, and other harm may be avoided the utmost care should be exercised in arranging the body of the unconscious patient and protecting his limbs.

Probably the ideal situation with respect to the patient's recovery is one in which transportation is first to a "recovery room" immediately adjoining the operating theater, wherein the patient is allowed to remain until consciousness is fully established. A certain number of patients will require especial care in the period immediately following operation, such as infusions and transfusions, and these can usually best be managed in physical surroundings especially adapted to the purpose and in close physical proximity to sterilizing rooms and instrument cases.

Unfortunately the "recovery room" is a luxury not always available, and frequently it becomes necessary to transport the patient immediately to his own bed. This may represent a rather considerable distance, particularly in the larger institutions.

Modern hospital construction has done much to minimize untoward accidents on the way from operating room to bed, such as chilling of the patient, asphyxia from inspired vomitus, and accidents incident to unnecessary lifting and shifting of patients; the distance from the operating room to the surgical wards and rooms has been shortened, transportation from one floor to another has been facilitated by the installation of elevators, and area-ways and passageways have been arranged so that they can be well heated and protected from draughts. However, there are still many active operating hospitals in which such ideal conditions do not obtain, and it sometimes becomes necessary to wheel the patient out of a superheated operating room into a cold passageway or even out of doors and

across a yard or enclosure, and in any case elevator wells are notoriously draughty places at best, so that the matter of carefully covering and wrapping the patient to avoid the possibility of undue chilling is invariably a matter of great importance. Even in those cases in which the passage from operating room to bed is normally short and quickly traversed the patient should be carefully protected from chilling since there are many accidental occurrences which may unexpectedly lengthen the normal time interval, such as elevators temporarily out of commission or mistakes in directions as to destination.

If unconscious or helpless patients are to be transported any considerable distance from the operating room, it is not only desirable but absolutely essential that some capable attendant be delegated to walk beside them and watch carefully for the development of any complications that may arise. Ideally this is the duty of the anesthetist because care of the anesthetized patient is his special province and, if competent, he is best able to deal with any emergencies that may supervene.

If possible the anesthetist should never leave a patient until that patient has regained consciousness; the practice of releasing an unconscious patient into the hands of an untrained, possibly mentally retarded, and often careless orderly or hospital attendant to be conducted sometimes considerable distances back to bed and then to be committed indifferently to the care of a student nurse, practical nurse, or graduate nurse, the attention of any one of whom is perforce likely to be occupied with other matters is, to say the least, undesirable. During the period of transportation the patient may develop certain rapidly fatal complications, such as asphyxia from "swallowing the tongue," "drowning," as the result of the inspiration of material regurgitated from the stomach, or may become quickly exsanguinated from an unexpected reactionary hemorrhage, in addition to suffering from a host of minor traumata which make for morbidity

rather than actual mortality. Orderlies, ward attendants, and other relatively untrained persons are in no position to recognize the development of such conditions, or to treat such emergencies intelligently when they arise. It has been the unhappy experience of too many surgeons to learn that a patient who had left the operating room in good condition a few minutes previously had died before he could reach his bed and that the attendant in charge of the patient had been quite unaware that anything untoward had occurred.

If the anesthetist cannot be spared to perform this most important function an especially trained nurse should be delegated to the duty, and it is highly desirable that such a person should be informed not only as to the anesthetic employed in any given case but also as to the operative procedure performed, in order that she may be alert to recognize any particular complications to which the individual patient may have been predisposed.

III. Reception of the Patient in His Bed

The preparation of "ether" beds and the reception of patients in their beds need not be detailed in this connection, because such matters are thoroughly discussed in treatises on practical nursing and are commonly well handled by the nursing staff. The patient's bed should, of course, be warm and unless special indications are present should be in a horizontal position or still better moderately inclined to the head; no pillow should be allowed until reaction from anesthesia has become completely established. During this period the constant attendance of the anesthetist or at least a competent nurse should be considered obligatory, since many of the complications previously noted as likely to occur on a transporting carriage are also likely to occur in bed during the period of unconsciousness. Unless definite contraindications exist the patient should be turned on the side, and in any case the head should be kept turned to the side.

IV. Care of the Patient in Bed

The early care of the patient in bed involves a discussion of the question of "postoperative orders," because it is customary for the surgeon to outline, in connection with the operative procedure, the treatment which he wishes the patient to receive during the initial twelve to twenty-four hours of convalescence. The postoperative orders are usually written on the patient's "operative sheet" at the operating table, and are transported with him to his bed.

A. The Administration of Morphine: Of all the indications during the earliest hours of convalescence the most important, from the point of view of both the patient and the medical attendant, is the relief of pain. Surgical procedures are invariably followed by a certain amount of pain, the degree of which varies not only with the nature and extent of the operative manipulation, but also probably with the sensitiveness of the individual patient to pain stimuli. The surgeon is ordinarily the least competent person to appreciate the nature and severity of his patient's sufferings, because familiarity, particularly the remote variety, breeds contempt in surgery as elsewhere, and the surgeon rarely or never has the experience of actually feeling the sensations which he provides for others as a part of his daily routine of life. However, the picture of the unfortunate surgeon who himself has to undergo an operative ordeal is sufficiently familiar to his professional brethren, and the usual insistent demands of such a one for speedy relief from his pain are frequently somewhat amusing in view of his own equanimity when others are suffering. At all events most surgeons who have recently had first-hand experience with surgery from the patient's point of view are willing to admit that the pain of operative manipulations is frequently gravely underestimated.

The only sure relief for ordinary pain is to be found in the administration of sufficient doses of opium, usually in the form of morphine, administered hypodermically. This opinion is

not universally shared by surgeons, however, and in fairness to those who hold a different view some space should be allotted to the reverse opinion. A few representative opinions as gleaned by Collins from recent literature are mentioned.

Clinton Cushing[1] holds that the less opium a patient receives after an abdominal operation the better, and the larger proportion of his patients receive no anodyne whatever. Deaver and Muller[2] believe that the giving of morphine after abdominal operations is occasionally responsible for a mortality and imply that the use of morphine is frequently undesirable. Skene Keith[3] says that no drug is capable of doing greater harm than morphine when used in a haphazard way. Haubold[4] believes that the administration of opiates is objectionable in principle but necessary in a certain number of cases, though he leaves us to infer that by far the greater number of cases do not need it. Moynihan[5] says, "The administration of morphine after an operation is rarely necessary nowadays, especially since the introduction of Crile's method (anoci association)," but he continues with the statement that he never withholds morphine if the patient is suffering, and also states that he uses both morphine and opium sparingly to the great advantage of his patients. Howard A. Kelly[6] advocates the use of morphine by hypodermic injection in doses of ⅛ or ¼ of a grain, for not longer than thirty-six to forty-eight hours, but he cautions against the use of the drug in hysterical women, and says that frequently when the patient is tired and restless, rather than in actual pain, a sponge bath with tepid water and a cup of hot water or tea will often take the place of a narcotic. He does, however, declare himself emphatically in favor of morphine by hypodermic injection during the first twenty-four hours in all cases of severe suffering. Possibly authorities are about equally divided on the subject of the routine use or non-use of morphine postoperatively, half of them believing that in the usual case it is contraindicated, whereas the other half think that it is indicated.

It will be noted from what has been said, however, that even those who disparage the postoperative use of morphine as a routine procedure recognize its value in certain cases, and therefore, in the absence of any definite proof that morphine as ordinarily used is particularly harmful, it is believed that it should not be withheld.

In accordance with the principles previously enunciated in connection with the preoperative use of morphine, doses of less than ¼ grain for adults weighing 125 lb. or more are probably not indicated. If morphine is to be used at all it should be used in doses sufficient to relieve the patient completely, and it should be given sufficiently early so that no interval of pain supervenes between the anesthesia of the anesthetic agent and the narcosis of the narcotizing drug.

Patients who regain consciousness and are subjected to suffering early in the postoperative period may lose their morale to such an extent that it becomes impossible to decide subsequently whether morphine is ineffective, and suffering has not been relieved, or whether complaints are fanciful and expressions of fear of anticipated pain. It is, therefore, usually desirable to order the first dose of morphine as soon as the patient is settled in bed, so that the actions of the anesthetic and of the opiate may overlap. On the other hand, patients who have been adequately relieved of the earliest and severest pain are much more apt to bear stoically such pain as remains when it becomes necessary or desirable to discontinue the use of opiates.

Although the postoperative requirements of patients with respect to opiates varies widely, a dose of ¼ grain of morphine administered every three hours for from 4 to 6 doses may perhaps be taken as a mean value. Some patients can dispense with the last few doses; many will require repetition of the standard dose somewhat less frequently; but it should be remembered that complete freedom from pain is the desideratum, and no hesitancy should ordinarily be felt in more frequent administrations if such seem to be required.

That the prolonged administration of opiates is highly undesirable no one will question. It is rarely advisable to keep patients under the influence of morphine for longer than forty-eight hours postoperatively, because of the danger of the development of the morphine habit or a toxic psychosis. At the end of forty-eight hours, if further continuance of the use of narcotics seems desirable, it is better to begin the gradual substitution of codeine for morphine.

Codeine, when used as a substitute for morphine, must be administered in comparatively large doses; doses of 1 grain are as small as can be used with any expectation of success.

B. Postoperative Administration of Fluids: The administration of fluids in adequate amounts postoperatively is perhaps the most important single therapeutic or supportive procedure at the command of the surgeon. The patient comes from the operating room (1) having lost relatively large quantities of water by diaphoresis, (2) having possibly vomited considerably and being almost inevitably bound to vomit some more, (3) in danger of developing a starvation acidosis from the withdrawal of food, (4) almost inevitably bound to develop within a few hours a rise of temperature accompanied by abnormally increased water metabolism, (5) usually under the necessity of eliminating quantities of toxins and other waste products by way of the urinary tract, and (6) inevitably bound to be intensely thirsty as soon as consciousness returns in case the operation has been performed under general ether anesthesia. Under these conditions the intake of a normal allowance of fluid, e.g., roughly 2 l. in the twenty-four hours, must be hopelessly inadequate.

Two general plans for supplying fluid postoperatively are recognized. In the first, the patient is allowed water by mouth just as soon as the period of immediate postoperative nausea and vomiting is over, and the amount of water given is dependent solely upon the patient's ability to retain and absorb it. Some surgeons prefer to give sips of warm water, others sips

of cold water, and still others small pieces of cracked ice. The temperature of the fluid is of relatively slight importance as compared with the main desideratum, which is quantity.

Undoubtedly there are many patients and many varieties of operative procedures in which such a method works very well. Especially would this be the case in operative procedures other than laparotomies and in those instances in which some other method of anesthesia besides general inhalation anesthesia had been employed. Unfortunately, however, as far as the postoperative administration of fluids is concerned, many operations are laparotomies, and generally inhalation anesthesia still holds the center of the stage as being, by and large, the method of anesthesia of widest application.

Though it is undoubtedly true that many patients are capable, notwithstanding this, of retaining and absorbing sufficient amounts of fluids by mouth, there are certainly some who react by developing a more or less persistent form of vomiting, and who, many hours subsequently, are still unable to tolerate anything by mouth, and this at a time when the need for fluids has become acute.

Postoperative vomiting works a very real hardship on patients, especially upon those subjected to the more serious laparotomies; the act of emesis not only exerts traction on wound edges and thereby causes pain, but the violent muscular contractions involved in the act itself rapidly exhaust the reserve strength of the patient, a reserve strength which is, after all, too little at best.

Of course, if patients become nauseated under any plan of treatment and persist in going through the straining movements incident to vomiting, it is far better that they should have something to expel than that a mere series of unsatisfying spasmodic muscular contractions should result; accordingly, a good plan is to give such patients copious amounts of fluid, thus assuring a thorough lavage of the stomach and this even though none of the fluid actually remains in the stomach to be subsequently absorbed. In all cases in which patients

vomit to any considerable extent, however, even though fluid is given in quantity it must be remembered that actually more fluid may be expelled than is swallowed because reverse peristalsis tends to become established, and secretions, not only from the gastric mucosa but also from the duodenum and its associated glands, tend to be evacuated. In the end, therefore, instead of supplying fluids by mouth one may actually abstract such fluids as are already present in the body, if the early administration of fluids by mouth provokes much nausea and vomiting.

The rectal or even parenteral administration of fluids constitutes the second plan, and though it is also open to certain objections, it nevertheless seems to offer advantages, especially in connection with patients who have been subjected to general anesthesia, and those who have undergone some rather serious operative ordeal. Rectal administration is specified rather than hypodermoclysis or intravenous infusion, not because the latter methods are less valuable but because rectal administration is considered less drastic and consequently more generally applicable and desirable. The entire subject of water balance and dehydration will be considered in some detail later in a separate chapter, and an attempt will then be made to evaluate more adequately all the methods of combating dehydration. Objections have been raised against the rectal administration of fluids both from the point of view of efficiency and also from the point of view of expediency.

The contention has been made that fluids are not absorbed readily from the rectum. This is probably true in case the administration is improperly made. Improper temperature of the fluid given, uncleanliness of the bowel wall, improper pressure relationships, and other factors will frequently lead to expulsion of fluid and failure of the method. On the other hand, many thousands of patients have tolerated it well when properly given, and there are very few surgeons who question its value in all cases.

About 1000 c.c. of fluid are ordinarily ample in cases of simple laparotomy to tide the patient over the initial period of nausea, which, under the plan of liberal narcotization with morphine, should not last more than from six to eight hours. At the end of this period patients characteristically tolerate fluids by mouth without much difficulty. Suffering from thirst has, in the meantime, been mitigated by the action of the narcotic and has also been actually combated by the rectal administration of fluids, so that the patient's morale is unbroken, and the temptation to overload the stomach with fluids is not great. Fluids are consequently more likely to be taken slowly and with moderation.

Plans involving a combination of rectal and "per os" administration of fluids in the early hours of convalescence are to be discouraged, because they invite carelessness on the part of medical attendants and nurses, and are apt to eventuate in a slipshod "trial and error" regime in which the way of least resistance dominates.

If the plan of rectal administration be followed, a rigid regime of "nothing by mouth" should be enforced. If the plan of "per os" administration be favored, water only should be allowed for at least from six to twelve hours.

c. The Postoperative Position of the Patient in Bed: In spite of the fact that much has been written on most of the other features connected with the postoperative care of patients, very little attention has apparently been paid to the matter of the desirable postoperative position of the patient in bed. Considering the number of patients who are either allowed or admonished in most hospitals to assume the dorsal recumbent position, it would seem that this position is the one of choice for a great variety of cases.

Actually, however, this is from both theoretical and practical standpoints probably not in accordance with the facts. The placing of patients in a stereotyped position, regardless of the operative procedure performed or the condition of the patient, is probably an evidence partly of timidity and partly of sheer thoughtlessness.

There was doubtless a period in the not too distant past when the art of abdominal closure was still relatively undeveloped during which patients who had undergone the ordeals of

FIG. 7. Patient sitting virtually upright in bed almost immediately following operation of thyroidectomy.

laparotomy had to be treated with the utmost gentleness lest complete rupture of the suture-line should occur, or at least sufficient stress should be brought to bear upon the suture-line as to render likely the development of a postoperative herniation. With modern technique in abdominal closure, however, such a complication is not particularly to be feared, provided that changes of position be executed with proper support to the body and with gentleness. The medical attendant need fear no harmful consequences in the average case from turning the patient from one side to the other, and certainly, except in rare instances, there is no excuse for enforcing the assumption for long periods of time of any position which is uncomfortable.

The position in which a patient ought to be placed in bed following operation varies with a considerable number of factors, some of which will be mentioned in connection with the

specific after-treatment of various operative procedures. For the present, however, a consideration of some of the general principles underlying postoperative posture only will be at-

FIG. 8. Patient in Fowler's position under treatment for diffuse peritonitis. Note 8 in. blocks under headposts of bed.

tempted. It is not infrequently desirable and perfectly feasible to allow the patient to sit virtually bolt upright immediately following transfer from the operating room to his bed; this applies particularly to cases of cranial operations and operations on the neck, such as thyroidectomies, and especially in cases in which local anesthesia has been used (Fig. 7). Such a position favors drainage of blood from the head and thereby tends to discourage the development of local edema. In operations on the neck such a position aids the patient in getting his breath through a trachea often partly collapsed either by accumulations of plasma or blood clot in the surrounding tissues. In the aged and in other patients in whom pulmonary lesions are already present or anticipated the upright position may be

most desirable in facilitating respiratory movements and ensuring adequate pulmonary ventilation. Patients with idiopathic asthma and those with cardiorenal disease can frequently tolerate no other position.

In arranging a patient in the upright position care should be taken to ensure muscular relaxation. Pillows and possibly other improvised supports should be used freely both at the back and sides, and especial care should be taken to secure and maintain a comfortable and natural bend at the knees, for few positions are more trying than one in which the thighs are flexed on the abdomen while the legs are maintained in complete extension.

The "Fowler" position, in which the trunk, limbs, and head are all in a relatively straight line, but in which the head and trunk are higher than the lower extremities is often a very useful position. It is most conveniently brought about by elevating the head of the patient's bed on blocks without otherwise disturbing the disposition of his body (Fig. 8). Blocks of various heights are useful, especially 6, 8, 10, and 12 in., one block being placed under one leg of the head of the bed and a block of the same height being placed under the other leg. Special beds, in which are incorporated mechanisms for raising and lowering the head and feet by means of cranks and levers, are unnecessary luxuries which do, however, possess the obvious advantage that they can usually be manipulated by a single pair of hands and do not require the outlay of an amount of strength beyond that usually possessed by female nurses and attendants.

The "Fowler" position is useful in combating respiratory embarrassment in patients too sick to tolerate a frank sitting or semi-sitting position. The respiratory relief is achieved chiefly through gravitation of the abdominal viscera away from the under surface of the diaphragm, thus facilitating unhampered diaphragmatic movements.

The "Fowler" position is also of the utmost value in the treatment of actual or anticipated peritonitis. To the late

John B. Murphy belongs much of the credit for the rationalizing of the treatment of general septic peritonitis following intestinal perforations of various kinds. He advocated the assumption of the exaggerated "Fowler's" position and the administration of the rectal drip.

Formerly, it was taught that the diaphragmatic peritoneum was absorptive to a greater degree than that of the rest of the abdominal cavity, and the reason assigned for the assumption of a postoperative head-high position was the avoidance of unnecessary peritoneal absorption. That absorption does take place more rapidly from the upper abdomen is not at all unlikely, although the reason for this is probably not to be sought in any peculiarity of the peritoneum of the upper abdomen itself but rather in the increased movement resulting from respiratory excursions in this part of the abdomen, a sort of peritoneal massage. A more important reason for maintaining a moderate head-high position in the average case of peritonitis is, however, the desirability of preventing residual abscess formation in the upper abdomen, where it might be relatively inaccessible surgically, and at all events difficult of diagnosis, and conversely to favor the development of such a complication, if such be unavoidable, in the pelvis, where diagnosis is easier because examination is easier and where evacuation without formal laparotomy is usually not very difficult.

The "broken" position is one intermediate between the sitting and the "Fowler" position. In this position, the head and trunk are elevated to make, with the lower extremities, an obtuse angle, while the thighs are somewhat bent upon the abdomen and the legs upon the thighs. In order to maintain the position with comfort the body must receive adequate support. A back rest either separate from, or incorporated into, the construction of the bed, serves to raise the torso, and a sling arranged under the thighs and attached to the head of the bed prevents the patient from sliding downward. Pillows are arranged to give lateral support to the body, and

ample support under the knees is provided also by means of pillows.

The "broken" position, being a modified "Fowler" position, shares with the latter its general advantages. However, the broken position is of especial value in connection with the postoperative care of patients in whom incisions have been made in the inguinal region, as it favors relaxation of the tissues in the groin. Such relaxation is especially desirable in inguinal hernipolasties in which traction on wound edges is particularly undesirable because of the danger of rupture of the suture-line and recurrence of the hernia.

The "dorsal recumbent" position in which the patient lies flat upon the back and the bed is horizontal is, as previously mentioned, perhaps most frequently used. When unduly prolonged, however, it tends to facilitate the formation of decubitus ulcers, as, of course, does also the prolonged assumption of any other position. Unless the normal dorsolumbar curvature is maintained by a suitable support, pains in the back and limbs frequently develop, due to prolonged strain upon the erector spinae muscles and tendons. The strict maintenance of such a position for prolonged periods of time favors also the development of hypostatic pneumonia especially in the aged, and is rarely or never necessary.

The "Trendelenburg" position, in which the head, torso, and extremities are supported in the same straight line, but the feet are higher than the head, is occasionally of value. Such a position tends mechanically to prevent the gravitation of secretions from the mouth and throat into the lower respiratory tract in the unconscious patient. It is, therefore, sometimes indicated in patients who are unduly nauseated postoperatively and who are either unconscious or semiconscious from the effects of anesthetics or narcotics, as well as in patients unconscious from other causes. In patients with visceroptosis such a position is most comfortable, probably mainly because it relieves traction on the mesenteric vessels and thereby relieves a condition of partial obstruction of

the duodenum at the point where the mesenteric vessels cross the duodenojejunal junction. The possibility of relieving certain cases of gastric dilatation by this position is mentioned elsewhere. In conditions of actual or threatened cerebral anemia such a position favors gravitation of blood to the head.

Meyer[7] and others have suggested the possibility of using such a position in the prophylaxis of thrombophlebitis, since the inclination of the body toward the head tends to prevent stasis of blood in the large veins of the lower extremity. So important does Meyer consider this use of the position that he has recommended its routine employment after the first forty-eight hours in all cases in which such a posture is not contraindicated by other considerations.

The "Sims" position either in its classical form or combined with either the "Trendelenburg" or "Fowler" position can often be used to advantage. The classical Sims position is attained on a horizontal surface by (1) turning the patient on the side (characteristically the right side), (2) pulling the dependent arm and shoulder backward so that the patient lies partly on the anterior aspect of the shoulder and partly on the chest, (3) partly flexing the dependent leg on the thigh and the thigh on the leg, and (4) fully flexing the upper leg on the thigh and adjusting the corresponding leg so that it rests on the supporting surface of the bed anterior to the dependent leg.

Raising the head of the bed on which a patient lies thus produces a combined "Sims" and "Fowler" position, and raising the foot of the bed produces a combined "Sims" and "Trendelenburg" position. Suitable arrangements of supporting pillows are necessary in order to make such positions comfortable for prolonged periods of time.

In those cases in which the gall-bladder bed has been drained or drainage of the common duct has been instituted after cholecystectomy, or in which simple gall-bladder drainage has been performed, the assumption of "Sims" position places the gall-bladder bed, or the gall bladder (if not removed)

in a relatively elevated position with respect to the skin incision, so that gravity drainage is thus facilitated.

The same applies to operative procedures in which the cul-de-sac of Douglas or the rectovesical pouch requires to be drained through an abdominal incision; the lowest part of the true pelvis, in the "Sims" position, is made to assume a position superior to that of the skin incision, and drainage is accordingly assisted by gravity.

The "Sims" position is of especial value in such cases in the early hours of convalescence, i.e., at the time when the need for adequate drainage is at its height. In such cases the "Sims" position should be arranged when the patient is placed on the carriage which conveys him from the operating table to bed and should be continued for from eighteen to twenty-four hours. At the end of this time the maximum amount of drainage will have occurred, and thereafter the patient may gradually be turned upon his back. Peritoneal exudation and vascular oozing will cease certainly by the end of the fourth day.

In the operation of gastroenterostomy the gravitation of gastric contents through the stoma between the stomach and the jejunum is much facilitated by causing the patient to assume a moderate "Sims" position and raising the head of the bed on blocks. Such a position is both grateful to the patient and tends to prevent vomiting, which may be a source of aggravation to both patient and surgeon.

v. Postoperative Backache

A large number of patients soon after operation complain of severe pain in the muscles of the back which does not usually subside for a number of days. Probably a frequent cause of this pain is the use of a flat, hard, operating table which does not take into account the normal lumbar curve of the back and the consequent production of back strain during operation. Back strain of this kind is frequently exaggerated by the leaning of operators and assistants upon the patient for support

or the placing of objects more or less heavy upon the patient's chest or abdomen. The treatment for such a complication is very obviously mainly a prophylactic one. A small pillow placed under the head, under the normal lumbar curve, and under the knees of a patient at the time of operation will do much to prevent the development of the condition. Nurses and assistants should also be impressed with the necessity of respecting the body of the unconscious patient to the extent of refraining from using it as a means of support either for themselves or for other objects, such as basins, pans, and trays.

VI. Postoperative Distention

The occurrence of a certain amount of distention or meteorism following abdominal operations is to be expected, though to nothing like the degree previously seen in the days when drastic preoperative purgation and unwise manipulation of the abdominal viscera during operations were more widely practiced and patients were taught to fear gas pains more than the operative procedure itself. Too tight or improper application of dressings may exaggerate an otherwise inconsiderable degree of distention, and much relief may be gained in these cases by judicious loosening or slitting of the restraining dressings.

In cases of moderate severity two simple expedients will usually suffice to give the patient very rapid relief: (1) If proctoclysis is being given it should be stopped and in place of the tube for the rectal drip should be inserted a fairly large rubber rectal catheter; this should be pushed well up above the internal sphincter and left in position; it allows the escape of gas which may be in, or find its way into, the lower bowel. (2) An electric light cradle should be placed over the patient's abdomen, the latter being thoroughly exposed by pulling the night gown well up, the bed clothing being replaced over the top of the cradle and the temperature within being kept at an even temperature of 100° F. by adjusting the number of light

bulbs in the circuit. The cradle takes the weight of the bed clothing off the patient's abdomen, the heat tends to produce muscular relaxation, and the combination of light and heat produces a mild local hyperemia. The relief experienced by patients receiving this simple treatment is often almost miraculous. A much more extended discussion of this subject will be given in a succeeding chapter.

VII. Postoperative Administration of Food

Patients who have been in comparatively good health prior to operation suffer no real hardship as a result of the inevitable short period of starvation which ensues upon major surgical procedures. For a period of twenty-four hours or more following laparotomy operations and general anesthesia a patient's gastrointestinal tract is in a state of paresis and depressed secretory activity and accordingly is unable to digest and assimilate food. This state of affairs is attested clinically by anorexia, and in case any irritation of the gastrointestinal tract coexists, by nausea and vomiting. Failure to respect this condition of affairs results either in expulsion of any food material which may be administered or in stasis of such material until digestion is actively resumed. Nothing but harm can result from too early attempts to feed the postoperative patient, and the overzealous medical attendant who attempts to force food by mouth at a time when the patient is in no condition to assimilate it courts the development of unnecessary nausea and vomiting, gastric dilatation, intestinal putrefaction and distension. Furthermore, in those patients in whom peritonitis is suspected or anticipated, administration of food by mouth is especially contraindicated because the presence of food material in the upper alimentary tract serves as an excellent stimulant to peristalsis, and inasmuch as motor activity always tends to diffuse a peritonitic process, a localizing peritonitis may thus become generalized. During the period of postoperative functional inactivity of the alimentary tract, therefore, a very definite indication is present for withholding

food, and during this interval nourishment, if urgently demanded, is supplied parenterally.

Return of function to the digestive tract is almost invariably manifested by a return of appetite, and for this reason a fairly safe rule to follow in average cases is to allow food as soon as the patient begins to feel hungry.

The first items in the dietary of the postoperative patient should contain a minimum of food value and should be in liquid form; the substances usually given first are weak tea, in which is dissolved a small amount of sugar but without lemon, bouillon or broth from which the fat has been carefully skimmed, albumin water or very thin gruel, and weak malted milk. These substances contain little real nourishment, require a minimum of digestion, and leave no residue. Milk itself is not a suitable article for early postoperative feeding because, although liquid when swallowed, it coagulates almost immediately on entering the stomach and thereafter must be treated as a solid food.

The first attempts at feeding constitute a sort of experiment which if successful may be cautiously continued, but which if unsuccessful must be interrupted until a further lapse of time has occurred. The amount of material given is small at first, merely an ounce or two, but the bulk usually can be rather rapidly increased if digestion is found to be active. Patients can frequently tolerate the aforementioned items of food at the end of about twenty-four hours. At the end of thirty-six hours in very favorable cases junket or oatmeal jelly may be added. On the third postoperative day in addition to the junket and oatmeal jelly, cocoa, ice cream, lemon or wine jelly, and strained gruel may be given. If the patient's condition is unusually good there may also be added thick soup, milk toast, cereals, custard, rice, chopped beef, baked potato, baked apple, and poached or boiled egg. Feedings should be allowed every three hours, and should be somewhat restricted in quantity. On the fourth postoperative day patients will frequently tolerate the ordinary full hospital diet.

VIII. The Use of Cathartics Following Abdominal Operations

Formerly it was the custom to give patients a cathartic on the third postoperative day in cases of simple, clean abdominal operations. Experience has taught, however, that not only is this procedure usually unnecessary but it is frequently quite harmful and leaves the patient in a restless and miserable condition. In the average case the bowel will have been fairly well emptied prior to the performance of the operative procedure, and during the two or three days following any operation the patient commonly eats but a small amount of food and usually food of a variety which leaves little or no residue. Accordingly the bowel, being relatively empty for a period of days after operation, no harm can result from allowing the patient to go for some time postoperatively without a bowel movement, and in any case, if it seems necessary on the third or fourth day to move the bowels, an enema meets the indication much more perfectly than a cathartic. Probably it is better to reserve the use of the enema until the fifth or even sixth postoperative day in those cases in which the bowel does not move spontaneously rather than to make use of this measure too early in the convalescent period. In cases of peritoneal inflammation carthartics may prove positively harmful and even exceedingly dangerous. Intestinal quiescence in postoperative cases complicated by peritonitis is a salutory provision of nature, and the flailing of the intestine to action by cathartics simply predisposes to the spreading of infection.

IX. Getting Up from Bed

The duration of the postoperative stay of a patient in bed is properly determined by a number of factors amongst which are the nature of the operative procedure, the extent and location of the operative incision, the manner of wound healing, whether by primary or secondary intention, and the age and general physical condition of the patient.

Recumbency in bed for a period of days postoperatively accomplishes two fundamental functions: (1) it tends to conserve the patient's reserve vitality and thus fortifies him against the effects of shock and hemorrhage, infection, toxemia, dehydration, acidosis, and the various other systemic complications of the operative procedure; and (2) it tends to put the site of operation at rest and thus, on the one hand, to favor repair and, on the other, to prevent separation of the wound edges during the period of incomplete union.

Accordingly, it follows that patients should not ordinarily be allowed out of bed until (1) systemic equilibrium has undergone complete readjustment and (2) wound repair has progressed to such a point that union of wound edges is secure, and no further danger of wound separation is to be feared.

Elevation of a patient's temperature and pulse rate is generally the most obvious evidence of unstable metabolic equilibrium, and ordinarily therefore constitutes a contraindication to any unnecessary exertion such as would be involved in getting up and about. Furthermore, care should be taken to recognize any less evident systemic derangements not necessarily associated with pulse and temperature changes, such as cardiac decompensation and nephritis. Other things being equal, however, the natural inclinations of the patient are about as reliable a guide as can be conveniently found; usually patients can be allowed out of bed as soon as they themselves feel capable of the exertion incident thereto.

The subject of wound healing has been considered at some length elsewhere. In connection with that discussion it has been stated that for the first three or four postoperative days tissue changes occur in non-infected wounds which are principally of a destructive or autolytic nature, and that not until the end of this period does the reparative process really begin with the multiplication and maturation of fibroblastic cells. Several very interesting experimental studies have been made tending to show that the tensile strength of a healing

wound is mainly a function of the growth of such tissue, and that a rather definite and constant curve of wound healing can be constructed for all types of wounds the characteristics

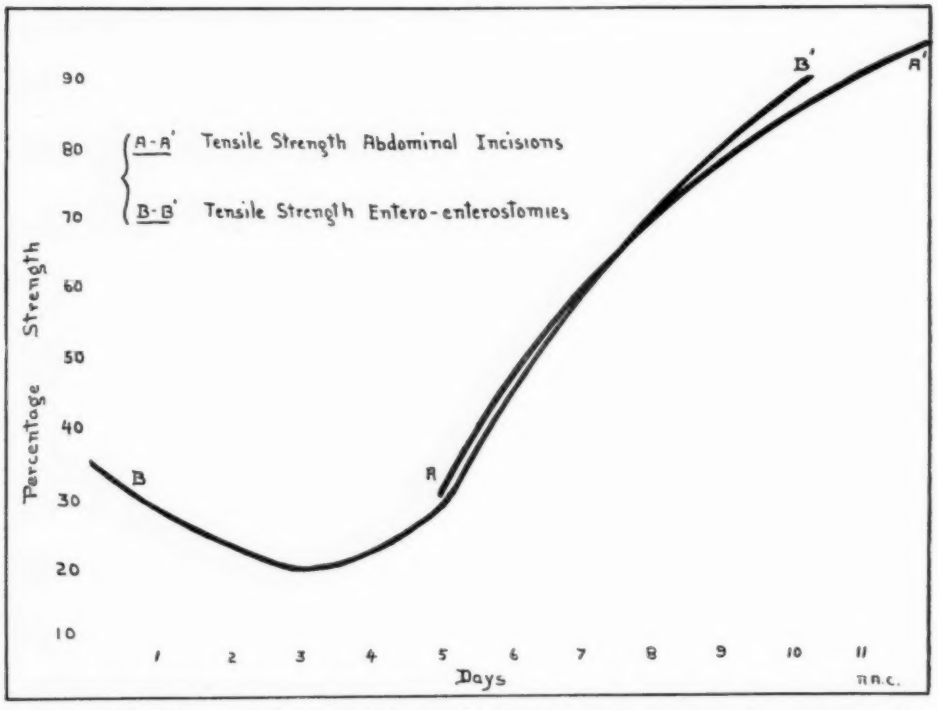

FIG. 9. Tensile strength of two different kinds of wounds on successive postoperative days. Curve A-A′ is taken from the experimental work of Harvey.* The curve B-B′ is reproduced from the experimental work of Cutting† and represents healing in intestinal wounds. Dogs were used in both sets of experiments. Curves represent mean values computed from a number of separate observations.

of which are a latent period of four days in which no appreciable healing occurs, an abrupt and maximal growth of tissue and increase in tensile strength of the wound beginning at the end of this period, which however progressively diminishes in rate during subsequent days and reaches an asymptote in from ten to fourteen days, at which time the tensile strength of the wound characteristically equals or even exceeds the

* Harvey, S. C. The velocity of the growth of fibroblasts in the healing wound. *Arch. Surg.*, 18: 1227, 1929.

† Cutting, R. A. The relative mechanical strength of enterostomies performed with and without clamps. *Arch. Surg.*, 17: 658, 1928.

preoperative tensile strength of the preoperative area and the postoperative tensile strength of surrounding tissue (Fig. 9).

In view of these findings certain rather obvious conclusions can be drawn with respect to the placing of stress and strain upon postoperative incisions. During the first three or four postoperative days such tensile strength as operative wounds possess they derive almost entirely from the mechanical trussing or splinting of the sutures or other mechanical devices introduced at the time of the operative seance or placed about the lesion then or subsequently. Because the tissues through which sutures are placed at the time of the original operation are usually firm and non-yielding the incision immediately after operation characteristically presents a degree of tensile strength somewhat greater than that presented by the same lesion after the lapse of a day or two at which time autolytic and inflammatory changes have produced more or less edema and tissue friability, and the suture material has become softened and partially liquefied.

For this reason, other things being equal, operative wounds are less likely to rupture immediately after operation than at the end of the first three or four days. The third, fourth, and fifth postoperative days, being the period of minimum tensile strength, represent the time interval during which particular care should be taken to guard the patient's operative incision against rupture. From the fifth day on, however, less and less danger may be anticipated from this source, and the patient may be up and about as soon as an amount of tensile strength has been developed sufficient in the operator's estimation and experience to present the necessary margin of safety required by the particular incision.

There are some surgeons who feel that such conditions are fulfilled in the case of simple small appendectomy incisions at the end of the fifth or sixth day, but a glance at the graphs of wound healing herewith reproduced shows that at this time only about 40 to 50 per cent of the normal tensile strength of the tissues has been developed. Consequently it seems

rather hazardous even under the most favorable circumstances to attempt so early mobilization of the patient. At the end of seven days nearly 70 per cent of the normal tissue strength has been developed in the wound, and usually this is considered sufficient in the case of lower abdominal incisions of moderate extent. Patients in whom extensive operative procedures have been undertaken and especially those with moderate or extensive upper abdominal incisions should be given the benefit of the added margin of safety of twelve or fourteen days' rest in the recumbent position.

These observations apply, however, only to wounds in which suppuration does not occur and to patients who are not debilitated by advancing age or systemic disease. In such cases and in wounds in which drainage tubes have been inserted or in which drainage is occurring without encouragement from mechanical devices the postoperative period of recumbency should be proportionately lengthened; in such cases no very definite rules can be formulated. Every case falling within such a classification presents its own individual problems; when one is confronted with such problems surgical experience and judgment alone can be trusted. Even at the hands of the most experienced surgeon cases occasionally undergo nonunion and subsequently rupture, and the surgeon is sometimes no less surprised than the patient when such a result is encountered.

As soon as the patient is allowed out of bed the medical attendant should consider the advisability of the application of some artificial support to the traumatized area. Undoubtedly there are many cases in which an abdominal support or binder is necessary in the early ambulatory period after laparotomies, but in cases in which no local complications have arisen the value of such devices is exceedingly doubtful. Patients usually wear such supports in case they are recommended or provided and believe they derive real benefit from them; but largely because of the influence of obstetricians who have found serious retardation in resumption of abdominal

tone and function following parturition in case abdominal supports are worn, surgeons have rather generally come to question the value of such methods. Probably in most cases a better plan of postoperative care is the early discarding of all mechanical devices and the gradual institution of a system of exercises designed to stimulate normal physiological function of the abdominal musculature or even a "work hypertrophy."

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Chapter IV

SHOCK AND COLLAPSE

CONTENTS OF CHAPTER IV

A. J. S. PAGE

I. Definition of shock and collapse 415
II. Mechanism of shock and collapse 416
III. Clinical recognition of shock 418
IV. Treatment of shock 419
A. Prophylaxis 419
B. The use of water and saline solutions 419
C. The use of gum acacia and gelatin solutions intravenously . . 420
D. The use of blood transfusion 425
E. The use of heat 426
F. The use of drugs 426
1. Morphine 426
2. Epinephrine 427
3. Ephedrine 428
4. Pituitrin 429
5. Caffeine, camphor, and strychnine 430
6. Alpha-lobeline 430
References 431

Chapter IV

SHOCK AND COLLAPSE

1. Definition of Shock and Collapse

The term "shock" is a clinical name for an abnormal condition or state, more or less well defined, which is characterized by a progressive fall in blood pressure, a decrease in pulse pressure, a subnormal temperature, and rapid, shallow respiration; in short, a state of depression of the so-called "vital functions."

Collapse is a term loosely applied to more severe degrees of this condition, especially in cases in which marked depression occurs suddenly or an initially mild condition of depression rapidly gives way to a more pronounced state of depression.

As a result of observations made during the war in the trenches and clearing stations, it has become customary to classify shock as (1) early, primary, or immediate, and (2) late, secondary, or delayed. Primary shock refers to the depression of the vital functions which occurs soon after an injury has occurred and which is precipitated by the patient's noting the extent of the damage done or realizing the gravity of the condition in which he finds himself, whether the damage be really great or the condition of the patient really grave seeming to matter little as long as the patient thinks it is so. The "shell-shocked" individual during the late war presented essentially the same symptoms and signs in the absence of severe physical trauma as did his comrade who suffered severely in actual combat. Mild degrees of primary shock are noted in civil life in connection with violent emotions, such as, fear, rage, and grief. Primary shock is of relatively infrequent occurrence compared with secondary shock and seems to be particularly prone to occur under the influence of hunger and exposure.

Secondary shock may occur as a result of (1) a prolonged operation or a serious accident, (2) loss of blood (hemorrhage), (3) excessive or rough manipulation of the viscera, particu-

larly pulling and dragging on the mesentery of the gut, and (4) the absorption of toxins, especially after abdominal operations on patients with suppurative peritonitis.

II. Mechanism of Shock and Collapse

Although various theories have been advanced to account for the clinical phenomena of shock on the basis of adrenal exhaustion, acapnia, and fatigue of the vital centers of the central nervous system by afferent pain stimuli, the only essential physiological phenomenon which has been demonstrated is deficiency of the volume of blood in actual circulation. Diminution in blood volume by exsanguination as a result of hemorrhage is a very obvious mechanism and either completely or partially accounts for by far the greater number of cases of shock and collapse. That shock may occur, however, without the loss of any blood either externally or internally is well understood.

In order to comprehend the mechanism by which diminution of blood volume may occur in the absence of actual loss of blood it is necessary to understand that normally there exists a very delicate balance between the amount of blood in the capillaries and the amount of blood in the rest of the cardiovascular system.

The amount of blood normally contained in the so-called "capillary bed," i.e., within the lumina of the capillaries throughout the body, though actually great, is nevertheless minimal, due to the tone of these minute blood vessels. The cubic capacity of the capillaries, however, is capable of undergoing rapid and enormous expansion under suitable stimulation; during active contraction and relaxation of muscular tissue the volume of this tissue may increase from 250 to 750 times, the increment being due entirely to capillary dilatation and ingress of circulating blood into the enlarged capillary bed. During certain types of shock there is a general capillary dilatation, and the patient actually bleeds into his own "capillary bed." The volume of blood which previously

filled the larger arteries and veins, being thus dissipated, these vessels tend to collapse, and the rate of blood flow within them is much decreased; the chambers of the heart accordingly fill and empty incompletely even in spite of a much increased cardiac rate. Capillary stasis, furthermore, rapidly brings about a peripheral condition of tissue anoxemia, and the acid waste products of incomplete combustion accumulate within the tissue spaces. These waste products increase the permeability of the capillary wall, and fluid escapes from the capillaries into the tissue spaces thus still further aggravating the primary diminution in available blood volume. Profuse sweating results, and the evaporation of sweat from the exposed surfaces of the body tends to reduce the general body temperature which has already become markedly depressed by virtue of compensatory vasoconstriction of the peripheral arterioles and venules, the tone of the arterioles and venules being under separate control from the capillaries as shown by Dale, Lewis, and others.

Dale, Laidlow, and Richards[1] have been able to produce in experimental animals a condition in all respects similar to clinical shock by the injection of the chemical substance "histamine." Whether histamine is the actual substance responsible for the development of shock in clinical cases is open to serious doubt, but Cannon[2] and Bayliss[3] produced evidence that some substance closely akin to histamine is found in injured tissue and when absorbed is capable of causing shock, as they have been able to produce experimental shock by allowing absorption to occur from a crushed limb in animals and have been able also to prevent or control the development of the same by preventing venous return from the part. This variety of experimental shock develops quite independently of the action of the central nervous system, as section of the nerve supply going to the injured member influences the course of events not at all.

Recently the hypothesis implicating such a histamine-like substance in the circulating blood as responsible for shock

has received considerable criticism. Smith[4] failed to find any such substance using direct methods, and Blalock and Bradburn[5] on the basis of determinations of the oxygen content of blood from various veins during shock found evidence strongly suggesting that generalized capillary dilatation does not occur, but merely capillary dilatation in the region involved by the trauma.

The mechanism underlying the production of shock as a result of the rough handling of certain viscera, traction on the mesentery, and section of large nerve trunks is apparently not one of capillary dilatation but rather one of widespread arteriole and venule dilatation. This type of shock tends to be minimal during deep general anesthesia, and also to cease with cessation of the stimulus; it must be regarded, therefore, as essentially reflex in character.

III. Clinical Recognition of Shock

Shock occurs clinically in a wide variety of degrees. In the *terminal* stage of shock the patient shows a profoundly apathetic mental reaction. The blood pressure, as previously mentioned, is low and steadily falling; the pulse is rapid and of small volume. The skin is either pale or slightly cyanotic and is covered with cold sweat. The respirations are rapid and shallow, and inspiration tends to be sighing in character. The limbs are flaccid, and there is little tendency to spontaneous movement.

In *mild* shock the circulatory system alone may be affected, the blood pressure being reduced, but in the mildest cases the pulse rate being relatively unchanged. The mental reactions of the patient may be unusually alert.

Between these two extremes occur many variations in the symptom complex, one set of symptoms being evidenced by one patient, another set by another, but always in conjunction with one degree or another of vascular depression.

IV. Treatment of Shock

Shock is, of course, a serious condition when definitely established and accounts for a considerable proportion of all surgical deaths.

A. Prophylaxis: Though many patients are first seen by the surgeon after shock or even collapse has already developed and for such patients active treatment is all that can be considered, the prophylaxis of shock is a matter which is of considerable importance in the practice of surgery, surgery involving, as it does, the mechanical manipulation of tissue. Rough handling of tissues, sepsis, the use of strong antiseptics, undue exposure of tissues to the air, and tissue drying, loss of fluids, especially blood, loss of body heat, fatigue, excitement, and starvation, must all be avoided if shock is to be successfully averted.

B. The Use of Water and Saline Solutions: As all shock, whether due primarily to actual loss of blood from the body, to bleeding into the patient's own capillary bed, or to profound vasodilation involving the arterioles and venules, is characterized fundamentally by a diminution in available blood volume, the essential indication in active treatment is for the addition of quantities of fluid to the circulation. In mild cases this addition of fluid may be satisfactorily effected by allowing copious amounts of water by mouth and by proctoclysis. Absorption of water from the gastrointestinal tract, however, occurs but slowly even under normal conditions and occurs more slowly or scarcely at all in the presence of venous stasis or tissue edema. Once the condition of shock has become firmly established the administration of fluids either by way of the intestinal tract of even by hypodermoclysis becomes relatively futile, because under such circumstances fluids actually pass out of the capillaries instead of being absorbed into them, and the addition of still more fluid to the tissue spaces simply serves further to increase the edema. In severe or well established shock the only means of supply-

ing fluid that can possibly avail is, therefore, the introduction of them directly into the vascular tree, and in the severest cases the only fluid which will remain for a sufficient length of time within the vascular system to be of permanent value is blood itself, for, due to the increased permeability of the vascular endothelium, artificially compounded solutions diffuse into the tissue spaces almost as fast as they are introduced into the blood stream.

This is particularly true of normal saline solutions and the more complex solutions of organic salts sometimes called "artificial sera," of which Locke's solution and Ringer's solution are examples.

Ten per cent solutions of dextrose are more efficient in raising the blood pressure than saline solutions partly because such solutions are actually hypertonic and partly because the molecule of sugar is so much larger than the molecule of salt that it tends to remain longer within the vascular tree and thus serves to prevent rapid elimination of water either by diuresis or by osmosis into the tissue spaces. Sugar solutions, however, like salt solutions, are of only temporary value. If such solutions be used, insulin should never be added to, or injected in connection with them, for insulin tends not only to reduce the amount of sugar in the circulating blood, the presence of which in abnormally large amounts is precisely the state desired, but insulin also exaggerates diuresis and diffusion of water into tissue spaces, thus facilitating loss of water from the vascular system, which is precisely the effect not desired. Practically, sugar solutions are only slightly more valuable than salt solutions, as their action is only transitory.

c. The Use of Gum Acacia and Gelatin Solutions Intravenously: Attempts have been made at various times to devise solutions possessing enough of the fundamental characteristics of normal blood to make them efficient in more or less permanently increasing the blood bulk.

As has been thoroughly appreciated since the experimental observations of Scott[6] in 1916, the walls of the capillaries are

permeable to water and to crystalloids but not to colloids, the one exception to this rule probably being the capillaries of the liver. Evidence for the permeability to colloids of the capillaries in the liver is found in the presence of a certain amount of protein in lymph taken from the thoracic duct.

The regulatory mechanisms underlying the passage of water through the walls of capillary blood vessels consist of osmosis and diffusion. According to the laws of physical chemistry, when two watery solutions of different osmotic tensions are separated by a membrane permeable to water but not to the substances responsible for the osmotic tensions, water passes from one solution to the other, and the force exerted by the water in its passage through the membrane represents the difference in osmotic tension between the two solutions.

The osmotic tension exerted by normal blood serum can be relatively easily measured, using a mercury manometer and a gelatin membrane, as gelatin has the same permeability characteristic as the wall of a capillary blood vessel: it passes water and crystalloids, but not colloids.

The osmotic tension of serum, as thus measured, varies normally between 30 and 35 mm. of mercury. This, as will readily be appreciated, rather accurately represents capillary blood pressure values obtained experimentally; indeed, it is primarily the balance between the capillary blood pressure and the osmotic tensions of the blood colloids which determines the water content of the circulating blood under conditions of normal permeability. When the blood pressure is low water tends to diffuse into the blood stream from the tissue spaces; when the blood pressure is high the reverse tends to occur. Abnormally, in shock, the permeability of the capillaries is increased, and normal pressure relationships no longer obtain.

During the late war a very serious attempt was made to compound a fluid for injection into the blood stream which would possess a colloid content similar to that of blood and

by its colloid content would tend to maintain osmotic relationships and thus prevent rapid loss of water through the capillary wall.

Most proteins are unsuitable for intravenous injection because of their tendency to produce either hemolysis or anaphylactic phenomena.

It has been determined that gelatin in 6 per cent watery solution or gum arabic in 7 per cent watery solution closely fulfils the theoretical requirements. Gelatin, however, presents two rather serious incidental disadvantages which are generally considered to render it unsuitable for the purpose under discussion: (1) it is very apt to contain tetanus spores, and (2) it shows a distinct tendency to produce intravascular coagulation of blood. Gum arabic solution presents neither of these disadvantages to the same degree. This substance has been used both experimentally and clinically so extensively that a considerable amount of evidence has accumulated with respect to its value.

A simple solution of gum acacia, be it said in passing, cannot be used for intravascular injection, for though its colloid properties are similar to those of blood its tonicity is not the same, and the blood corpuscles undergo hemolysis, they, in contradistinction to the capillary wall of blood vessels, being not only impermeable to colloids but also to sodium chloride and other salts. For this reason gum acacia solutions must always be compounded in physiological saline solution, the so-called "gum-saline" solution, if untoward effects are to be avoided.

Bayliss[7] has been the especial proponent of gum acacia solutions in the treatment of shock and hemorrhage. He believes that such solutions are both non-toxic and efficient when properly prepared and injected and presents evidence to support his view both from the bedside and from the experimental laboratory. In support of the contentions of Bayliss is the experimental work of Barthelemy,[8] Brodin, Richet, and Saint-Girrons,[9] Rouse and Wilson,[10] and Mann.[11]

Additional favorable clinical reports have been made by Keith[12] and by investigators from the Mayo Clinic, Adson and McIndoe[13] and Huffman.[14]

Unfavorable reports on the use of gum-saline solutions have not found their way into the literature in any considerable numbers. The Council on Pharmacy and Chemistry of the American Medical Association condemned the method mainly because gum acacia produces profound disturbances in the physicochemical equilibrium when added to blood in vitro. Bernheim[15] and Lee[16] reported untoward reactions as the result of injection of gum-saline, and Appelmans,[17] Hanzlik, DeEds, and Tainter[18] and Kruse[19] have discussed possible harmful actions of such solutions.

Because, presumably, of the assertion of Davis that the infusion of gelatin solutions tends to favor intravascular clotting little attention either experimental or clinical has been paid to this particular type of blood substitution solution. Wolfson and Teller,[20] however, have recently presented evidence to show that in animals gelatin solutions may be used with beneficial effects apparently similar to those claimed for gum-saline solutions and that intravascular coagulation is not particularly favored thereby.

In the presence of contradictory evidence as to the value of any surgical method, such as has been presented with respect to both gum-saline and gelatin solutions when used as substitutes for blood, the surgeon should be exceedingly wary. In general, it may be assumed with some accuracy that only those observers who are more or less enthusiastic about new methods write about them, and enthusiastic persons are proverbially given to unconscious exaggeration. The individual who uses a new method critically and without any preconceived conviction and who, therefore, is in the best position to put into writing a just evaluation of his results when he has arrived at well-founded conclusions is usually either too busy or too disheartened to report unfavorably.

The fact that these blood substitution fluids were used rather extensively by numbers of surgeons during the war

and were subsequently abandoned, even while the need of solutions possessing their supposed beneficial characteristics was most pressing, speaks rather eloquently as to their general unsuitableness and inefficiency.

In fairness, however, to the entire subject of the artificial preparation of substitutes for blood, it should be said that undoubtedly the time will eventually come when an efficient substitute will be found, and in the meantime much credit is due those investigators who have already pioneered in the field. Furthermore, it is quite possible, as some of the ardent advocates of gum-saline solutions have urged, that some of the discredit which has been cast upon the use of gum Arabic has been undeserved and is directly traceable to the use of an improperly compounded product.

According to Telfer,[21] Bayliss,[22] and Osterberg[23] and Huffman,[24] the considerations of importance in compounding a suitable gum-saline solution are apparently as follows:

1. Only lumps or "pearls" of gum acacia of the greatest purity should be used in the preparation of the solution; these should be clear and nearly colorless. Powdered preparations are generally worthless.

2. The addition of calcium to gum Arabic solutions is not necessary, for the gum itself usually contains enough of this substance.

3. The use of distilled water of considerable purity is highly desirable; the most careful investigators have used freshly prepared and triply distilled water.

4. As gum acacia may contain resistant spores the solution should be autoclaved before use.

5. A biological test for toxicity is advisable before using solutions clinically; larger doses than are planned for injection into man are first given to experimental animals.

A suitable technique for the actual preparation of a gum-saline solution is the following:

1. Weigh 480 gm. of acacia and 72 gm. of sodium chloride and place in a 4-l. flask of resistance glass.

2. Add about 500 c.c. of freshly prepared triple-distilled water and stir with a glass rod over a hot water bath until as much as possible of the acacia has been dissolved; decant the resultant fluid into an 8-l. flask; add

another 500 c.c. portion of water and repeat the process. Continue this until all of the acacia has been dissolved, and make up the resulting solution to a full 8 l.

3. Autoclave the resulting turbid solution.

4. Filter under sterile conditions through a Buchner funnel fitted with a soft filter paper.

5. Re-sterilize the solution twice in the autoclave and allow any flocculent material which forms as a result of this procedure to settle to the bottom of the flask.

6. Siphon off the clear supernatant fluid into flasks of suitable size under sterile precautions, plug the flasks with sterile cotton or gauze and set aside until required. The solution remains suitable for use for several months.

Injection of gum-saline solutions should proceed slowly, not more than 20 c.c. being introduced into a vein per minute.

D. THE USE OF BLOOD TRANSFUSION: Inasmuch as the following chapter is devoted to the subject of blood transfusion most of the discussion which might otherwise have been well undertaken at this place will be found in succeeding pages. In general, however, it may be stated that although blood transfusion is specific in cases of shock due to hemorrhage, its value in shock secondary to capillary dilatation is quite doubtful, and in the treatment of shock secondary to arteriole and venule dilatation the administration of blood transfusion is also of questionable efficacy. The reason seems to lie in the fact that though there is undoubtedly a deficiency in the total volume of circulating blood this phenomenon is more or less accidental, the fundamental derangement being the peripheral changes previously outlined and being essentially physicochemical in nature. The filling of the cardiovascular tree with blood or any other suitable medium is of value insofar as it tends to support the circulation, but, after all, such treatment is merely symptomatic and unless conditions favorable to a resumption of normal peripheral vascular tone can be achieved, the abnormal peripheral physicochemical changes will ultimately be sufficient of themselves to cause death.

Early hot saline infusions undoubtedly are of greater value than delayed blood transfusions, because the fundamental aim of the treatment of shock is preventive. When recognized early, shock readily yields to ordinary supportive treatment, whereas when recognized late and in its firmly established form any and all kinds of treatment will probably fail.

E. The Use of Heat: As shock and collapse represent fundamentally a depression of the vital functions, and because the activity of the vital functions is indissolubly connected with combustion and the formation of heat, one of the most important considerations in the treatment of these conditions is the maintenance of the body heat at or near a normal level. This may be achieved in a number of different ways. One of the most obvious is the application of external heat to the body of the patient making use of hot-water bottles, electric heating pads, the electric light tent, or other suitable measures and concentrating one's effort especially on the extremities of the patient. Internally heat may be conveniently supplied (1) by means of hot drinks: the stomach may be virtually converted into a hot water bottle lying against the liver and great vessels, (2) by means of hot infusions: heat is supplied directly to the circulating blood, and (3) by means of diathermy.

Crile and Higgins[24] advocate the use of diathermy as one of the most potent factors at the command of the surgeon in the treatment of shock and hemorrhage. They cite the fundamental chemical law that within certain limits an increase of 1° C. in temperature hastens chemical activity by 10 per cent, and ask what stimulant or drug has a metabolic effect at all comparable to this. The electrodes of the diathermy apparatus are applied so as to concentrate heat in and over the liver and the great vessels, aorta, vena cava, and vena porta.

F. The Use of Drugs: 1. *Morphine:* Generally speaking, the value of drugs in the treatment of shock and hemorrhage is virtually nil with the single exception of morphine. Morphine is, of course, fundamentally a depressant drug when administered in ordinary doses and for that reason might on casual

consideration seem to be contraindicated, inasmuch as the vital functions are already too far depressed in shock. The unfavorable influence of anxiety and fear on the development of shock has, however, been mentioned, as well as the fact that patients in shock are frequently quite acute mentally. The sedative influence of relatively large doses of morphine on the mental processes of the patient far outweighs any accidental depressant action of a physical nature which may accrue, and this drug is actually of the utmost value for this reason.

Drugs classed as "cardiac or respiratory stimulants" are without exception of little or no value in the treatment of established shock, because (1) respiratory failure is always secondary to cardiovascular failure, and cardiovascular failure in turn is due to no essential inadequacy of the cardiac mechanism itself but rather to peripheral circulatory deficiency, and (2) such drugs as are available are actually inefficient in shock and collapse.

From theoretical considerations it might be supposed that the drugs commonly used to increase the blood pressure by direct action on the arterioles and venules, i.e., the vasoconstrictor drugs, might be of value in the treatment of shock.

2. *Epinephrine:* Epinephrine is the most active of the blood pressure raising drugs which depend upon this vasomotor mechanism, and as has been shown by Pilcher, Wilson, and Harrison,[25] is capable of increasing the cardiac output from 10 to 59 per cent when injected into normal animals. According to the experimental findings of Rouse and Wilson,[26] however, animals subjected to hemorrhage or prolonged ether anesthesia show a diminished response to the action of the drug: the more exsanguinated, or the more deeply anesthetized the animal, the less efficient is the drug, frequently three or four times the normal amount being inefficient. When it is given in sufficient quantities a typical rise of blood pressure is noted even in the presence of hemorrhage according to Pilcher and his associates,[25] but the duration of the effect is not more than seven minutes, and at the end of this period of elevation the blood

pressure and cardiac output show a tendency to fall even below the initial level and to remain there.

These characteristics of epinephrine render its use in the treatment of shock virtually valueless except in cases in which it is given as a temporary measure during preparations for the more valuable procedures previously discussed, especially transfusion.

3. *Ephedrine:* In many or most of its pharmacological properties ephedrine closely resembles epinephrine. It is an alkaloid derived from the Chinese "ma huang" or Ephedra vulgarus. The active principle of this small, practically leafless, shrub was isolated in an impure form by Yamanashi as early as 1885, but only in 1923 was a preparation made of sufficient purity to permit a determination of its chemical structure; credit for this valuable work belongs to Chen.[27] The crude drug has been known in China for at least 5000 years.

According to Chen and Schmidt[28] the essential physiological action of ephedrine is that of raising the blood pressure by a mechanism of peripheral vasoconstriction and cardiac stimulation. This effect is seen whether the drug be taken by mouth or injected by hypodermic needle. Although the effect on blood pressure is identical with that of epinephrine the duration of the effect of ephedrine is much longer than that of epinephrine, twenty minutes or more in experimental animals.

This characteristic action of ephedrine on the circulation is seen, however, only when the vascular system is functioning in a relatively normal manner and when the drug is given in not too large doses. Toxic doses when administered to the intact animal may lead to cardiac failure, and the isolated heart when perfused with solutions of too great concentration is thrown into fibrillation and soon ceases to beat at all. In the dog a toxic action results from the administration of 40 to 65 mg. of the drug per kilogram of body weight.[29,30]

In well established shock and hemorrhage the action of ephedrine is not at all such as might be expected from a con-

sideration of its normal action. Chen[31] has shown experimentally that when injected into animals having lost 25 per cent of the total blood volume or animals much depressed by the action of circulatory poisons, such as histamine and peptone, ephedrine may not only fail to raise the blood pressure but may actually cause the death of the animal. Fatal results are especially apt to follow the administration of the drug after a more or less prolonged period of continued low blood pressure (thirty minutes), and this may result even though the dose of ephedrine is relatively small (1 mg. per kilogram).

As Chen and Schmidt say (*loc. cit.*) ephedrine is certainly not to be considered a specific for shock or hemorrhage. It is of no value in cases in which a preliminary injection of epinephrine fails to produce a satisfactory effect and is capable of producing a lethal result when employed after shock or hemorrhage have become well established.

In connection with efforts to provide adequate volume to the circulating blood, especially in connection with transfusion, the drug probably has a value similar to that of epinephrine and under these circumstances its judicious use may be distinctly indicated.

4. *Pituitrin:* Aside from its action on the uterine musculature, in which action pituitrin is virtually specific, pituitrin would seem to be a very unreliable pharmacological agent and a much over-rated one. It is said to have a definite vasoconstrictor effect on the peripheral blood vessels generally, and therefore to be a useful agent in increasing the blood pressure; but experimentally this certainly is not invariably the case, and occasionally actual depressions of the blood pressure have been noted even in apparently normal animals. In any case, the blood pressure raising effect of the drug is only temporary. Possibly the occasional depression of blood pressure which is seen is dependent upon cardiac dilatation, which, according to Oliver and Schaefer,[32] occurs immediately after injection of the drug. In general, the vasoconstrictor effects of pituitrin are not nearly so great as those of epi-

nephrine and adrenalin, and in view of its unreliability as a vasoconstrictor it is correspondingly less efficient.

5. *Caffeine, Camphor, and Strychnine:* Caffeine, camphor, and strychnine are three drugs which formerly enjoyed some favor in the treatment of vascular depressions, but which, when subjected to the acid test of examination by experimental methods, have proved to be quite worthless as blood pressure raising agents.

Caffeine, as shown by Pilcher, Wilson, and Harrison,[25] not only fails to increase the cardiac output, but actually diminishes it; the greater the dose of caffeine-sodio-benzoate given to dogs, the greater is the reduction in cardiac output.

Camphor has been shown by Bodo[33] and Winterberg[34] to be not a vasoconstrictor but actually a vasodilator unless sufficient doses be given to cause convulsions; the coronary vessels share in the general vasodilatation. Camphor also acts as a depressant to the cardiac musculature.

Strychnine was formerly used as a cardiac tonic, but no tonic effect has ever been demonstrated experimentally, although Bodo[33] attempted to obtain such an action from heart-lung preparations in the dog.

6. *Alpha-lobeline:* Alpha-lobeline is one of the four alkaloids which have been definitely isolated to date from *Lobelia inflata.* Dresser[35] in 1889 first isolated the substance in relatively pure form as a platinum double salt, but in 1921 Wieland, Schoepf and Hermsen[36] were able to isolate a pure hydrochloride and establish the empirical formula which is at present accepted as correct.

Alpha-lobeline is apparently the most active alkaloid of lobelia. It has gained a foothold in therapeutics largely as the result of the experimental investigations of Wieland and Mayer[37] who found that in certain stages of depression of the respiratory center induced by urethane, morphine, and chloral hydrate in pigeons and rabbits excitation could be produced by the administration of the drug. These authors recommended subcutaneous or intramuscular injection of alpha-lobeline

rather than intravenous administration because when given by the latter route the drug sometimes caused tonic and clonic convulsions, induced direct and reflex depression of the respiratory center, and produced harmful affects on the cardiac muscle.

Further and more critical studies of the action of alpha-lobeline, though they have not been in essential conflict with the earlier studies which dealt with only slight degrees of depression, have served to modify profoundly the initial optimism of users of the drug in combating profound depressions. King, Hosmer, and Dresbach[38] have produced experimental evidence to show that in dogs, cats, monkeys, and rabbits considerably depressed by various drugs or by increased intracranial pressure, stimulation of respiration by alpha-lobeline is either slight or actually absent and the blood pressure, which under lesser degrees of depression is elevated, becomes under these circumstances actually depressed. The blood pressure decreases at times were sufficient to cause the death of the animals. Alpha-lobeline, like adrenalin, is capable of producing hyperglycemia. King, Hosmer, and Dresbach have collected a large number of experimental and clinical reports, especially from the German literature, confirming their own observations.

Whitehead and Elliott[39] studied the effect of alpha-lobeline on the mammalian heart by means of electrocardiographic tracings and found that whereas relatively small doses of the drug resulted in a lowering of the heart rate, somewhat larger doses increased the rate and regardless of the dose a 2:1 heart-block was frequently induced.

Obviously a drug which fails to influence the respiratory function favorably and which reduces the blood pressure and commonly produces a 2:1 heart-block in depressed patients is a very poor one to use in well established cases of shock.

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